# ARMY ORDNANCE

VOL. XIV, No. 79 JULY-AUGUST, 1933

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## Aggression and Aggressive Weapons
*Major General J. F. C. Fuller*

## We Must Have Munitions Training
*Edward W. Goss*

## Early History of American Ordnance
*Brigadier General William H. Tschappat*

## Defense Against the Hedgehopper
*A Symposium*

## Mobilizing the Conservation Corps
*Col. Duncan K. Major, Jr.*

## Our Arsenals and Their Personnel
*An Editorial*

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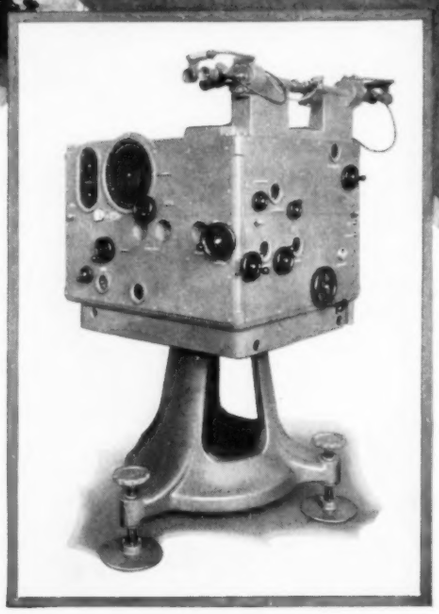

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# ARMY ORDNANCE

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"Peace and harmony with all nations is our sincere wish; but such being the lot of humanity that nations will not always reciprocate peaceable dispositions, it is our firm belief that effectual measures of defense will tend to inspire that national self-respect and confidence at home which is the unfailing source of respectability abroad, to check aggression and prevent war."—*Thomas Jefferson, May 23, 1797.*

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THE Army Ordnance Association is a national organization of American citizens pledged to industrial preparedness for war as our nation's strongest guarantee of peace.

The Association endeavors to keep alive an interest in and knowledge of the design, production and maintenance of munitions. Other than a few manufacturing arsenals—six in all—there is no peace-time industry for the production of ordnance. Should war unhappily come again, industrial America will be called upon to produce munitions in great quantity and of intricate and unusual design. In an emergency time will not permit careful study or long preparation for the production of munitions. The problem is one of vital concern.

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To assist in effecting industrial preparedness for war as being one of the nation's strongest guarantees of peace;

To keep available the highly specialized knowledge necessary for arming the manhood of the nation by stimulating interest in the design and production of ordnance material;

To promote mutual understanding and to effect cooperation with American scientists, inventors, engineers and manufacturers in civil life and the regular and reserve officers of the Ordnance Department.

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To assist in developing and maintaining an efficient personnel, both commissioned and enlisted, for the units required for Ordnance Field Service in the event of an emergency;

To commemorate the services rendered by the industry of the nation and by the officers and civilian employees of the Ordnance Department in the wars in which the United States has been engaged.


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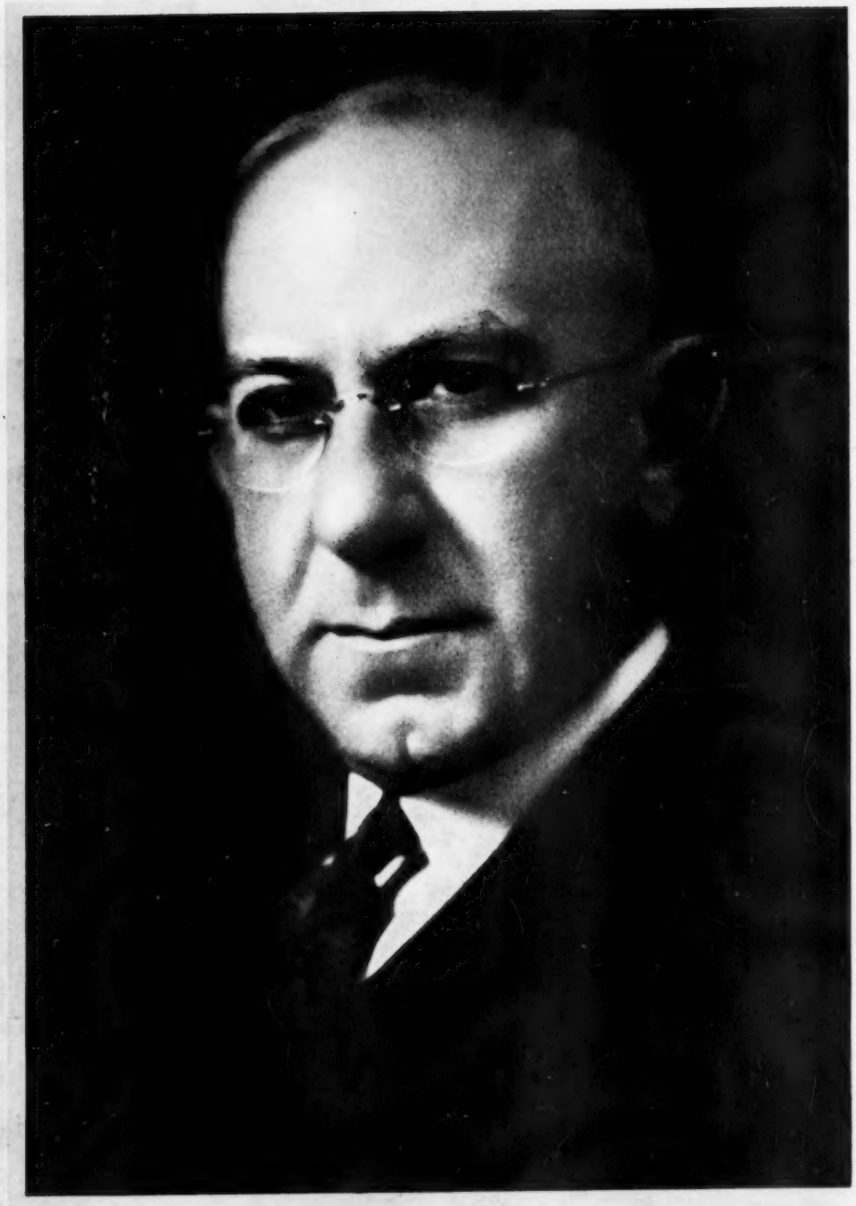

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Samuel Kahn

Chief, San Francisco Ordnance District

ARMY ORDNANCE

Vol. XIV JULY-AUGUST, 1933 No. 79

# Aggression and Aggressive Weapons

## *The Absurdity of Qualitative Disarmament*

By Major General J. F. C. Fuller*

WE live in a demented age in which everything is upside down and down side up. We know perfectly well what caused the last war and what will cause the next, namely, excessive nationalism girt round and about by economic ramparts which turned each European nation into a robber band, a band which can only live by pillaging its neighbors.

Because during peace time robbery is carried on by cornering, under-selling, tariffs, protection, trade embargoes, subsidizing and diplomatic threats and persuasions, in all of which no blood is spilt, it is called political action or foreign policy, but in no case war; consequently such action is considered to be nonaggressive. Yet surely the meanest intellect should realize that the spilling of blood is but an incident, and that all these means of undermining the economic strength of other nations and compelling them to keep to heel are aggressiveness itself. In brief, aggression is a political and not a military question, and though armies, navies and air forces are political instruments, unless policy is aggressive they in no sense can become aggressive. In fact to talk of an aggressive weapon is really a contradiction in terms.

Does the politician realize this? Of course he does, for though most politicians are knaves, few are complete fools. A racketeer knows perfectly well that if he gives up his racket his gun becomes purely a defensive weapon, it is his racket which makes it an offensive one. So does a politician know that it is his policy which potentizes military force and that through a change of policy only can military force cease to threaten. Why then does he not cut this Gordian knot of conflict by changing his policy? Not only because his bread and butter depend upon its maintenance (just as a racketeer's bread and butter depend upon his racket), but because the structure of the country he represents has been built upon it and the people have been told time and again that their prosperity and security, their very existence, are founded on it. In short, the politician has become so involved in his racket, so wound up and entangled by lies and hypocrisies that he can no longer speak the truth and live.

Since the ending of the war, conference after conference has been assembled. At each the delegates have realized clearly enough what ought to be done, and realizing it this is the last thing they have attempted to do. One after the other in the assembly room they have fired off volleys of good will and of brotherly love . . . "the spirit of unity unites us" . . . "humanity demands" . . . "we stand before the judgment seat of posterity" . . . "the next war will wreck our civilization" . . . etc., etc. What is all this for? To convince each other? What a jest! They know as well as I do and you do that all this is the most consummate hypocrisy. Why then do they speak thus? The answer is simple: to supply copy for the press, and by means of this copy the press chloroforms the public.

Reader, if you do not believe me, walk over from the assembly room to the apartments and hotel suites which these people inhabit and which incidentally we, the gulled public, pay for. Listen to them over their cocktails (also on public account), and you will find that though in one place a man is a complete humbug in another he is a charming and most generous (see above) host. He will, if he has any humor at all, openly acknowledge that all he has said is "rubbish," but there it is. . . . "After all, the Frog was very keen on his submarines. . . . I wonder why? Well, you never know; I shall send a dispatch to my Government. . . ." And on this tip what does his Government do? It puts twelve more destroyers in commission and budgets for six new submarines during the following year; then to cover its action it talks loudly of disarmament.

WHAT are these conferences in fact? Gigantic international pig and whistle shows. Take the Geneva Disarmament Conference, it is the most perfect example. It opened like a circus amidst blares of trumpets. The people were told that it represented 64 countries; that it was to be attended by 2,400 delegates and experts, 500 journalists and that the two conference rooms had an area of 13,000 square feet! "Assembled here," said Mr. Henderson, the chairman, "are the chosen spokesmen of seventeen hundred million people. There is no human being, whether his home is in one of the great centres of industry and population, in the deserts of Africa, in the jungles of the East, or amid the ice of the Arctic regions, who has not some one to speak in his name." Think of that; yet it was sound political claptrap. The people were enthralled, they opened wide their mouths, then down went the dope—40 disarmament plans since February last year, including one from the Dominican Republic which reads: "Considering that the League of Nations desires to spread among the childhood and youths of the countries of the world ideals of peace, fraternity and international cooperation . . . the delegation of the Dominican Republic to the Disarmament Conference has the honor to propose that the Conference should agree to recommend to all the countries here represented that they should agree to prohibit the manufacture of warlike toys." In other words, disarmament is a matter for the nursery!

*Major General, British Army. C.B., C.B.E., D.S.O. Author: "Tanks in the Great War" (1920); "Reformation of War" (1923); "Foundations of the Science of War" (1925); "Atlantis: America and the Future" (1925); "Pegasus: Problems of Transportation" (1925); "On Future Warfare" (1928); "The Generalship of U. S. Grant" (1929); "Lectures on F.S.R. II" (1931); "Lectures on F.S.R. III" (1932); "The Dragon's Teeth" (1932).

Each of these so-called peace conferences, which also are in actual fact immense chaotic general staff meetings maneuvering for the best place in the next war, has been wrecked on the question of the aggressor, and though much scholastic wisdom has been expended on its definition, it would appear to be as unsolvable a problem as that of "How many angels can stand upon the point of a needle?"

Having debated this knotty point for a dozen years, in December last the French put up a new plan with a new definition. Aggression was to be defined as "the presence of troops on territory not their own" and would be certified by a standing international committee appointed by the diplomatic representatives and military attachés accredited to the Government of the State aggressed against. This commission would proceed to the place where the alleged invasion had occurred, and from it report to the Council of the League of Nations which shall decide the rights and wrongs of the case by a majority vote.

Whoever thought out this proposal must have been either a lunatic or a humourist. Picture the scene telegraphically: "Arguments, heated words, howling mobs, turmoil. An arrest, an assassination, twenty Jews murdered in Berlin and reported to Paris as being Frenchmen. Ultimatums, ambassadors packing, airplanes sailing around in hundreds under false colors. Trucks rushing to the frontiers at fifty places. Soldiers leaping out in Czech and Polish uniforms, dashing into German territory, rapidly changing behind Teutonic bushes, bolting back to their own country to invade it in brown shirts covered with swastikas. Hysterics in Prague, calisthenics in Berlin, Warsaw demented. Same on all frontiers. Two hundred acts of aggression reported. International committees run off their legs, seven hundred reports submitted to the League. Geneva bombed by six nations simultaneously in order to establish each other's criminality. Geneva rebombed, now off the map. Repeat Hell, Gehenna and the Plutonic regions. Cheerio." Conundrum: find the aggressor?

No, this really will not do in spite of the fact that President Roosevelt has also proclaimed that an aggressor is a nation which sends military forces across its own frontier. In theory he may be right, but as to fact—read the above telegram.

FOR a boot to cross an imaginary line on the map is not in itself aggression, for to become so depends entirely why it crossed it, and this is a political question. For instance, is not the U.S.S.R. aggressive when she foments Communist revolutions in other lands? Is not the Irish Free State aggressive when she withholds payment of the English annuities, and England aggressive when in turn she declares a tariff war on Ireland? How can a commission appointed by diplomatic representatives and military attachés settle such points? And even if it could, what is to happen unless the decision of the Council of the League is unanimous—a most unlikely eventuality? What if there are counter-charges? Will the minority nations fall in with the majority vote? If not, as under the Pact of Paris neutrality, as well as war, has been outlawed, they must either join the alleged aggressor or attack both parties simultaneously. Here we are back to the third and fourth centuries A.D. when contending Caesars fought for Caesarism.

France wants security, and security to France really means hegemony over Europe. At Versailles, in 1919, France stood where Napoleon I had stood in 1807. At Tilsit the Little Corporal said to the assembled kings: "It is part of my system to weaken Prussia; I mean that she shall no longer be a power in the political balance of Europe." And since 1919 French policy has been no other than that of his nephew Napoleon III when he said: "Certain people say the Empire is war. I say that the Empire is peace, and when France is satisfied the world is tranquil." Satisfaction meant predominance, predominance means potential aggression, because it must create actual discontent.

France though girt round with fortifications, upon which since the war she has spent over $150,000,000, and possessing an army of some 600,000 men, is nevertheless terrified of Germany. And why? Because the French are logical enough to know that aggression is not a military but a political question. It is for this reason that she is so intent in her search after a definition of the aggressor. Her one and sole object is the maintenance of the *status quo*. By the Locarno Treaty she roped in Great Britain to agree to this, and ever since her main effort has been to draw the United States into a similar compact. So persistent have been her efforts that at length, on May 22, 1933, Washington spoke: "In the event of the States in conference determining that a State has been guilty of a breach of the peace in violation of its international obligation and taking measures against the violator, if we concur in the judgment rendered as to the responsible and guilty party, we will refrain from any action tending to defeat such collective efforts which the States may thus make to restore peace." More shortly put: "If there is a war, if you agree who is the aggressor and if we agree that you are right, then we promise to do nothing!"

This unique piece of sophistry was pronounced in Great Britain to be a masterpiece, not because it in any way helped France but because British politicians saw in it a weakening of the U. S. A.'s claim to freedom of the seas. Its vacuity at once fired the imagination of Englishmen. A day or two after its pronouncement, Sir Austen Chamberlain proclaimed that "to define an aggressor in legal terms would be to warn him what steps to avoid; knowing the rules he would carefully walk round them. Surely it would be better to act in our English way: we should know an aggressor when the time came to recognize him."

Carried to its logical conclusion what does this mean? It means that to make certain that international law and agreements should be made fool- or rather knave-proof, they must be founded on complete vacuity. Thus "War = ?" "Aggression = ?" "Security = ?" "And what action will be taken = ???" If Moses had written "Thou shalt not?" ten times running on his tablets, there would have been no necessity for him to have smashed them on the ground, for the Chosen People would have become so aggressive that they would have smashed them on his head. The definition of aggression having ended in zero I will now turn to my second problem.

IF the problem of aggression is beset with difficulties that of the aggressive weapon is surrounded by absurdities, for the simple reason that an inanimate thing cannot be aggressive. For example, no one would call a table or a chair aggressive, except perhaps in the meaning that it offends the eye; yet if I seize upon a chair and fell someone to the ground with it, it is strictly true to say that the chair has been used in an aggressive way. The difference between a chair used as a weapon and a true weapon, such as a rifle, is the purpose underlying their manufacture, the one is made to sit on and

the other to kill with. All weapons are made in order to develop lethal power, and this power may be used either offensively or protectively. Thus, I may walk into the jungle to shoot a tiger, or I may walk into it and use my rifle to protect myself if the tiger tries "to shoot" me.

I have entered into this explanation in order to clear the ground of certain illogical weeds. A weapon is not aggressive, or offensive, or protective; it is simply a lethal mechanical contrivance, which can be used offensively or protectively. Further still, the offensive does not necessarily mean the aggressive. Aggression, in its military meaning is "an unprovoked attack." Thus, when, in August, 1914, the Germans invaded Belgium, this was undoubtedly an act of aggression; but when the French simultaneously invaded Southern Baden and penetrated to Mulhausen it would seem that their intention was a protective one; for their aim was not to invade Germany from this direction but to prevent Germany invading France and occupying the Belfort gap. This point cleared, I will now turn to the nature of weapons.

IT would take more space than a short article provides me with to examine this problem in detail. Roughly speaking, before 1914 land weapons could be divided under the general heading of field weapons and siege weapons; but on account of the introduction of mechanical traction during the war this division disappeared, because the heaviest siege pieces could be moved almost anywhere by locomotive or tractor. Thus it happened that the elimination of the horse reduced this division to a vanishing point, and we soon find that all field armies are equipped with heavy and medium artillery as well as with field artillery, rifles and machine guns. All these weapons I will call the "old category."

To this category was added a new one consisting of three different weapons—lethal gas, the airplane and the tank. There can be no doubt whatever that this new category possessed increased powers, and that had the war continued a year or two longer than it did they would have largely ousted the old category and would have changed the nature of tactics.

It is to prevent this change that the qualitative principle has been propounded. Thus, Captain Liddell Hart, an exponent of this doctrine, writes: "The just reason for the restriction of weapons as a method of disarmament lies in the fact that by curtailing the initial power of aggression it may hinder an aggressor getting his own way." The only means whereby the attack was enabled to make partial headway in face of such defense "was by the use, first, of an overwhelming mass of heavy artillery, and second by the use of tanks. . . . Thus it logically follows that if we restrict these two means we place a definite handicap on the offensive and so on aggression. . . . Abolish such weapons by agreement, and there would be little chance of successful aggression—and so a real discouragement to any would-be aggressor. Here is the essential argument for the qualitative method."

I will now follow up this argument and see where it leads us to. First, it must be realized that the power of weapons is a relative question. For example, the nineteenth century rifle is a far more powerful weapon than the eighteenth century musket; but abolish the rifle and at once the musket regains its lost powers, and in its own type of war is as powerful as the rifle is in its, and certainly more destructive of life, for the percentage of casualties in musket warfare is considerably higher than in rifle warfare.

Captain Liddell Hart does not agree with this, and considers that any comparison between musket warfare and rifle warfare is a fallacious one; he writes: "In the days of the musket, inaccurate and short in range, the offensive had the advantage over the defensive. It was the advent of the rifle and its evolution into the machine gun which gave the defence the advantage over the attack. Hence, if we were to abolish the rifle and machine gun the attack would regain its lost power. Whereas, if we abolish the heavy gun and tank the defensive superiority of the rifle and machine gun is inevitably more assured."

Is this so? I doubt it. First, it is not true that in musket warfare the musket was the primary factor in the offensive. But what is true is, that mobility has always been the primary factor in the first and stability in the second. As long as armies are small enough to maneuver freely and are commanded by generals with an equal mobility of mind, it does not matter whether their men are armed with muskets, rifles, or machine guns, for offensive power will be high. But increase the size of armies, as they were increased during the last century, until they number hundreds of thousands and even millions of men, then maneuver becoming impossible defensive warfare will predominate. Therefore qualitative disarmament is antagonistic to quantitative disarmament; consequently Captain Liddell Hart's argument depends for its logic on the maintenance of the nation in arms, that is upon enormous hordes of men which can only be attacked frontally. His outlook would therefore appear to be based on the tactics of the last war.

Now it is perfectly true in such a war that rifles and machine guns will prove more powerful defensive weapons than muskets and case shot, but should quantitative disarmament take place this defensive power will be largely cancelled out by the motor car, because as long as complete frontiers are not protected, the mobility of this vehicle will enable turning movements, outflanking attacks and rear attacks to be made. Irrespective of the weapons used, the motor car is likely to produce in tactics as radical a revolution as the incursions of the Gothic, Parthian and Mongol horsemen did centuries ago.

AM I right? Captain Liddell Hart apparently does not think so, for to render qualitative disarmament fool-proof, that is to assume that the defensive shall become so powerful that no offensive can succeed, not even one based on motor car mobility, he intends so closely to fortify frontiers that they will become impenetrable. He says: "It is to the preponderant advantage of the defender to ensure that there can be no invasion in the first place. If there is no possibility of successful attack, there is no need for a counter-stroke—and no need for the defender to have the means of making it."

Now, as I cannot help feeling that Captain Liddell Hart's first argument is based entirely on what happened in the last war, and, consequently, presupposes a return to its hordes, so, I think, that this his second argument rests upon his having concentrated solely upon the Franco-German war problem. It is perfectly true that the French frontiers, which are narrow and which are protected by many natural features, can at great cost be completely fortified, consequently for such frontiers his argument holds good. But take the German frontier, or the Polish, or the Russian, and a totally different problem presents itself. To make these attack-proof would run into thousands of millions of dollars, and to garrison the

thousands of works built would demand hundreds of thousands of men. If, as he suggests, their strength should be such that no mobile field army need be kept behind them, then to avoid a sudden surprise attack they will have to be as fully garrisoned in peace time as in war time. Thus, for example, Poland has an attackable land frontier of about 2,500 miles in extent. Supposing that this frontier is protected by a five mile deep belt of works, and that each mile requires a battalion of 800 men to garrison it, then Poland will require an army 2,000,000 strong, and as I have pointed out this must be its peace establishment, because unmanned works are useless to meet a surprise. In her turn, Germany will require about 3,000,000 men, and France, omitting her Swiss frontier, 600,000, or the actual standing army she now has.

From these figures alone we see that qualitative and quantitative principles are very closely related. If quality goes down quantity must go up if security is to be established, and if it does not go up it is not possible either to render frontiers fool-proof or in field warfare to produce flankless fronts of men as happened in 1914-1918. Without these two conditions mobile warfare will result and the side which is better prepared to make use of its motorized forces will be in a position to be far more aggressive than most eighteenth century armies or the German armies in 1914.

Having so, I think, demolished the main arguments put forward by the most able exponent of the qualitative principle, I will now attempt to show that it is not only retrogressive but in actual fact impracticable.

OBVIOUSLY the aim of disarmament is not to abolish war, for the main cause of war cannot possibly lie in weapons. Its object is to restrict war, and as we are repeatedly told that another war will destroy our civilization, then its aim should be not only to make the outbreak of war difficult, but war itself less destructive. This point has been completely overlooked by the qualitative school. Thus, to go back to the old category of weapons is, in idea at least, to go back to nineteenth century warfare. In actual fact this of course is impossible, because the motor car alone renders it impossible; but the qualitative exponents have overlooked this engine, their whole idea is to render warfare static, like the greater part of the World War. This war cost the world 10,000,000 lives, counting killed in battle only, and at a somewhat conservative estimate $200,000,000,000.

Do they want a repetition of such a war? Not in fact but only in idea, for they imagine that if the idea of war becomes unprofitable this will restrict its outbreak. Will it? Not for a moment do I think so, because democracies are far too ignorant and emotional to be convinced by logic, and the soldiers who advise their governments are in the most part disbelievers in the powers of the new weapons. As conditions stood in August, 1914, it was a certainty that offensives based on the bayonet must fail, and they did fail. Yet immediately after the war what do we see? Bayonet tactics are reinstated and every effort is made to get rid of tank, gas, etc. Even today, in every army, there are more believers in bayonets than in tanks, in cavalry than in aircraft, and if the new weapons are abolished what difference will it make intellectually, for the bulk of the soldiers will charge magazine rifles and machine guns just as they did in 1899, 1904 and 1914.

"But," says the qualitative enthusiast, "they will not get through." No, they will not get through, but this will not stop disciplined men from fighting. They will charge and charge again and will be slaughtered by tens of thousands. Democracies will go mad with rage. A scramble for victory in the air will follow. Tanks will be built and launched into battle with untrained crews; areas will be inundated with gas and submarines, like wolves, will once again roam the high seas. Madmen will invent and slaughter and be slaughtered, and if in the end no side can claim a victory, all sides will be swept by bankruptcy into Bolshevism.

BUT may not it be argued that twentieth century warfare with weapons of the new category will prove even more destructive than nineteenth century warfare with weapons of the old category? Certainly, but facts are against this contention. Relatively the Napoleonic Wars were considerably more destructive than the World War, and the Thirty Years War was far more destructive than the Napoleonic. History may, however, be a false guide; then turn to facts, facts deduced from the World War. Its destructive nature depended on its length, and its length on the difficulties of meeting the bullet on the defensive, and not until newer weapons arrived did the bullet begin to lose its power. The tank saved thousands of lives, possibly hundreds of thousands; lethal and non-lethal gases proved themselves to be formidable weapons; yet whilst 23.4 per cent of bullet and shell casualties were fatal, amongst gas casualties only 1.87 per cent were so. Above all, the airplane transferred war from the battlefield to capital and industrial cities, and whispered: "You civilians made this war, and you civilians shall suffer for it."

Here we touch the very bottom of the qualitative problem. War is terrible, but to the civilian war makers the most terrible form of a terrible war is one which interferes with their cherished tradition of making wars and not fighting in them.

It was I believe Viscount Cecil of Chelwood who was first brought to bed of the qualitative idea. This one-eyed fanatic of peace, who a short time ago did his utmost to precipitate a conflict between the League of Nations and Japan, put forward his views on the disarmament problem on January 14, 1932. They were based on the idea of enhancing defence and so weakening attack. What he wanted was the abolition of all weapons invented in recent years and a return to the military *status quo ante bellum*.

When the Disarmament Conference opened in February, 1932, Sir John Simon, the British delegate and a pacifist in 1914, proposed "the outlawry by international agreement of certain weapons and methods of warfare," because, "it seems to me," he said, "that we are most likely to find these weapons and methods among the most recent developments. This is not only because it is the most recent lapses in habit which are the least difficult to eradicate, but because these new methods of warfare—the use of gas and submarines and of bombing from the air—all have this common feature, they tend to obliterate the boundary as drawn by Hugo Grotius . . . that as far as possible a distinction should be effectively drawn between combatant and non-combatant."

To the man in the street this may sound logical enough, but to anyone who has studied the subject it is the veriest claptrap. First, the world has vastly changed since the days of the noted author of *"De Jure Belli et Pacis"*—written in 1625! Then the civil population took no part in war; now

they play an essential part, because not only does war depend on the popular will, but directly war is declared the whole of each belligerent country is turned into an arsenal. In France, in 1917, 3,000,000 men were enrolled as soldiers and 1,700,000 men and women as munition workers. If in everyday life a civilian and a soldier enter into a compact to murder someone, and the civilian makes the knife and the soldier cuts the victim's throat, both will be tried for murder, and, if found guilty, both will be hanged. Secondly, as regards "recent lapses in habits," weapons do not change because soldiers want to change them, they change because civilization changes and they are compelled to change them. Thus in the 1830's the British Admiralty considered that steam power was a "bad habit," so the utmost was done to prevent the construction of steamships, and we know the result. The truth is that you must either march with civilization or against her.

TO protect the war makers and war workers at the expense of the fighters is today utterly immoral. First, it means the reliance on quantity in place of quality, of hordes of men in place of small mechanized armies. Hordes in their turn demand conscription and conscription is but another name for the nation in arms, the curse of the nineteenth century, because it educated whole nations to believe in war as an end in itself. Secondly, it means that in another war thousands of soldiers will be slaughtered in cold blood because the very means which would mitigate this slaughter have been denied to them in the name of peace and humanity! On this question General von der Goltz wrote over forty years ago: "Nothing is worse than that the" soldier "should feel himself neglected in this respect, and to believe himself subject without his own fault, to an effect to which he is powerless. Defeat would thus appear excusable, and success cannot have a worse enemy than this feeling." To equip armies with obsolete weapons when better can be obtained is to Bolshevize them. In a Bolshevized army mutiny may become a sacred right and revolution eliminate the war makers even more rapidly than "qualitative" attack.

Granted then that the newer weapons will limit the destructive effect of horde warfare, the question now arises: Will they restrict the outbreak of war? In all probability, and were the nations rationally interested in the maintenance of peace they would ban the older weapons, those used by soldiers to kill soldiers, and they would endow the new, especially the airplane and the submarine, with *legal* power to attack the makers of war, the civilians, and not the soldiers directed by their will.

The terror of the new may halt war, the powers of the new will certainly shorten it; but reliance on the old will do neither. If civilization crashes it will do so just because such theories of qualitative disarmament are accepted, and because they are reactionary. Half our trouble today is due to our looking backward on 1913, on 1869 and even on 1625. It is this looking back on Sodom and Gomorrah which petrifies all reasons.

At length I come to my final point: Can military mechanization, for this is the central problem in qualitative disarmament, be abolished, or even restricted, without abolishing the mechanical sciences and industries themselves?

To suggest the abolition of science is absurd, consequently to talk of abolishing the new weapons is absurd. The tank, bombing machine and lethal gas are but special forms of the tractor, civil airplane and chemical industry, just as the hedger's bill was father of a formidable medieval weapon which could sever a horse's head, the hunting bow of the long bow, and the sporting rifle of the military rifle. Abolish these sons and the fathers will remain, and unless they are also abolished we have not stopped the war clock, but have simply put it back. To read wrong time for right is excessively stupid.

For example, tanks are not used in civil life, but so peaceful a machine as a Fordson tractor can be converted into, what I will call, a tank of the second degree, in a few hours. Though a wheeled machine, the special equipment, invented by Roadless, Ltd., will at once turn it into a tracked machine, and a few bullet-proof shields into a tank. It is true that such a machine will not be as "aggressive" as a Christie tank, that is to say, if it is called upon to fight one, but abolish the Christie tank and similar machines, and it will become as "aggressive" when compared to infantry as a tramp steamer mounting a 6-inch gun would have been to Nelson's three-deckers at Trafalgar or even to the "Monitors" and "Rams" of 1862-65.

No, tanks, bombing machines and lethal gas cannot be abolished, because in wars of the second degree their civil forbears are as "aggressive" (offensively powerful) as they themselves are in wars of the first. A nation such as Russia, which is in the process of mechanizing its agricultural equipment, has in reserve thousands of potential tanks of the second degree which will sweep all before them unless met by similar machines in equal numbers or by tanks of the first degree. In fact, by attempting to abolish the knock-out blow we may actually be facilitating its delivery.

If we are out to abolish war, well and good; then let us abolish armies, navies and air fleets lock, stock and barrel—this anyhow is an honest suggestion. But if we are not going to abolish war we must prepare for it, and there is more hope in the ultimate solution of the problem of world peace in preparing for it rationally than in putting forward a host of insane and hypocritical suggestions. Be progressive or be damned—these are mankind's alternatives.

(EDITOR'S NOTE: The Geneva Disarmament Conference, before which have been proposed the definitions of an aggressor and the qualitative theory of armament limitation as discussed by General Fuller, is now in recess. Some committees of the conference are continuing their studies during the interval. The conference is scheduled to reconvene in October.)

# We Must Have Munitions Training

## *A Program of Ordnance Educational Orders for Industry*

By Edward W. Goss*

EVERYONE, it seems, interested in American ordnance in time of emergency has been thinking or talking in terms of educational orders for the past fourteen years. I have done my share both in private life and as a member of the United States House of Representatives. I have gone considerably further and have endeavored to translate this thought and discussion into action. I am more than pleased to avail myself of the invitation from the Editor of Army Ordnance to discuss the subject briefly in these pages particularly as to the status of educational orders as it is today.

I take it that it is not necessary to present the subject in elementary terms to readers of this Journal. No group of American citizens has done more to foster a safe and sane ordnance program in time of war and no other class of individuals is as definitely pledged to this type of peace insurance as are members of the Army Ordnance Association. I can recall many articles by authors of the highest repute which have been published here analyzing the educational orders phase of the national defense from almost every angle. Some of these included the testimony of manufacturers who in the dark days of war were face to face with engineering and production problems of which they knew absolutely nothing. They started from scratch, so to speak, when there was not a minute to spare. Many of them did admirably, but delay with consequent increased cost of production and in some instances an unsatisfactory product is, to say the least, not the way for the United States to achieve efficient national defense. I recall too the splendid leadership in this field as acclaimed in these pages of the great war-time Chief of Ordnance of the Army, Maj. Gen. C. C. Williams, now retired, whom I look upon as the father of the ordnance educational orders idea. Neither can I be forgetful of what the late General Ruggles accomplished in fostering this plan and what leaders in many lines of commercial manufacture have been able to do in lending their approval and support to it.

The plan proposed by Colonel Hodges in the last issue of Army Ordnance wherein he urged educational orders at this time both to perform their first function of education and especially as a priming force for industry in the depression is worthy of special mention. Such an emergency expedient would have tremendous results from both viewpoints and I hope that it will be possible to have Colonel Hodges' suggestion adopted in some definite way.

NOTWITHSTANDING all this fine leadership and effort, educational orders as a reality are still nonexistent. Many of our well intentioned people think they see in them some sort of an insidious effort of munitions makers (!) to keep the wheels of industry turning in time of peace. It is a great pity that individuals can be so shortsighted as not to realize that it is solely because we have no munitions makers in this country that educational orders are necessary. If there were in the United States a small group of producers whose plants were constantly turning out ordnance of latest design, or even ordnance of any design at all, then we could forget forever the very term educational orders. We would have them in fact. As it is, there is not a single company in the United States which can be classified as a munitions maker in the strict sense of the term. This being so, there must be some way of keeping commercial industry familiar with the actual production of limited quantities of ordnance. Otherwise we have only our six Government manufacturing arsenals which are known to have only about five per cent of the manufacturing capacity required for an ordnance program in the event of a major war.

I will not recall the efforts made in the past to have the necessary legislation which would permit the War Department to award educational orders to qualified producers. The history of these efforts over the past decade is a long and fruitless one. I am anxious, however, to acquaint members of the Army Ordnance Association with the latest bill (H. R. 123) which I introduced in the House of Representatives on March 9, 1933, and which was referred to the Committee on Military Affairs. It is a brief proposal which speaks for itself. I quote it in full:

"A bill to provide for placing certain educational orders to familiarize private manufacturing establishments with the production of certain ordnance, and to provide for manufacture of certain ordnance by Government-owned arsenals.

*"Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,* That the Secretary of War is authorized and directed to solicit bids from private manufacturing establishments for the manufacture by them of such guns, ammunition, and other ordnance munitions of war, and parts thereof and accessories therefor, as are of special and/or technical design and noncommercial in character (hereinafter called 'special ordnance'). Bids shall be solicited only from such establishments as, in the Secretary's judgment, will be competent in time of war to manufacture the particular class of special ordnance with respect to which the bid is solicited. In the determination of which classes of special ordnance are to be manufactured under this Act, and in the determination of which of the solicited bidders is to be awarded any contract, the Secretary shall have regard solely to the selection of such classes of special ordnance and of such bidders as will, in his judgment, under all the circumstances, best serve the interest of the United States and best promote the cause of national defense. The Secretary of War shall enter into no contract under this section without the approval of the President.

"Sec. 2. Not more than one contract for the manufacture of the same, or substantially the same, article of special ordnance shall be granted to the same individual, partnership, association, or corporation within any period of three successive years. This section shall not prohibit the awarding of any contract during any war in which the United States is engaged.

"Sec. 3. The Secretary of War, with the approval of the President, is authorized and directed to provide for the manu-

*Member of Congress from the 5th District of Connecticut.

facture of special ordnance at Government-owned arsenals.

"Sec. 4. To carry out the provisions of this Act, there is authorized to be appropriated the sum of $2,000,000, during each of the five fiscal years beginning with the fiscal year during which this Act is enacted. Sums appropriated shall be available for expenditure, one-half in connection with contracts under section 1, and one-half under section 3."

IT will be noted that this proposed legislation pertains only to what is called special ordnance, that is to say, any of those complicated technical designs which are non-commercial in character. Further, the solicitation of bids is restricted to those companies which will be capable of producing such special equipment, the ultimate purpose being the competency of a particular bidder to serve the interests of the United States in time of war and thus promote the national defense.

In order that there may be an equitable distribution of such limited funds as would become available under this legislation, the provision that not more than one contract shall be granted to the same producer within any period of three successive years is only fair. Spreading available work and funds among qualified manufactureres is inherent in the entire plan.

It is probably in sections 3 and 4 of the proposed legislation that the biggest step toward making educational orders practicable is undertaken. Educational orders, as I understand them, have never been proposed and would never be utilized to the exclusion of our Government owned arsenals. No matter how much we emphasize the need for an educated American industry in this line of endeavor, the place of the Government owned arsenal in our scheme of national defense must be secured. Our arsenals are basic in the ordnance educational system. They are the primary and secondary schools of ordnance learning, and more, they are the universities and postgraduate schools. From them in time of war must come the teachers to train and guide the commercial manufacturer in the design and production of munitions. Hence it is that an educational orders program which would aim to eliminate the Government arsenal is faulty. The ideal situation is to have the arsenals carry on hand in hand with the commercial manufacturer. In this spirit the above bill is drawn. It provides, as will be noted, for a five-year program during which the private manufacturer and the Government-owned arsenal would operate in the production of special ordnance, share and share alike.

ON the score of money, a total of $10,000,000 would be provided over a period of five years at the rate of $2,000,000 a year. Of this $1,000,000 would be used annually in the production of special ordnance in Government arsenals and $1,000,000 annually for the same class of production in private establishments. This distribution is intended to be most fair and in my judgment it is so. Whatever objection there might be to it may come from those well intentioned citizens who throw up their hands in horror at the mere thought of a program such as this. The reply to that objection is the lesson of our past experience. Two million dollars a year of public funds for five years is inconsequential. In one year—that of 1929—four times that amount was expended for the publication of Government pamphlets. During the World War our defense program was costing almost that much an hour. The cost of this proposed educational orders program is indeed modest in the light of such comparisons. Those who are at all familiar with the costly procedure of an untrained industry in time of war attempting to produce ordnance equipment will agree that if this legislation is not ultimately adopted then history will repeat itself and we will enter the next emergency as uneducated from an ordnance standpoint as we were when we entered the last. It is because I hope this condition will not become a fact that I again introduced in the Congress an educational orders bill and I intend to continue to urge its enactment. Ordnance educational orders are sound in theory and essential in fact. There can be no mistake about that.

In my opinion, if this measure is enacted into law, after a five-year program, private industry would be in a position in time of emergency to advance its ordnance delivery schedule by two months' time—a priceless advantage if war comes.

**Only by Peace-time Education Can Industry Produce Such a Weapon as This in War.**

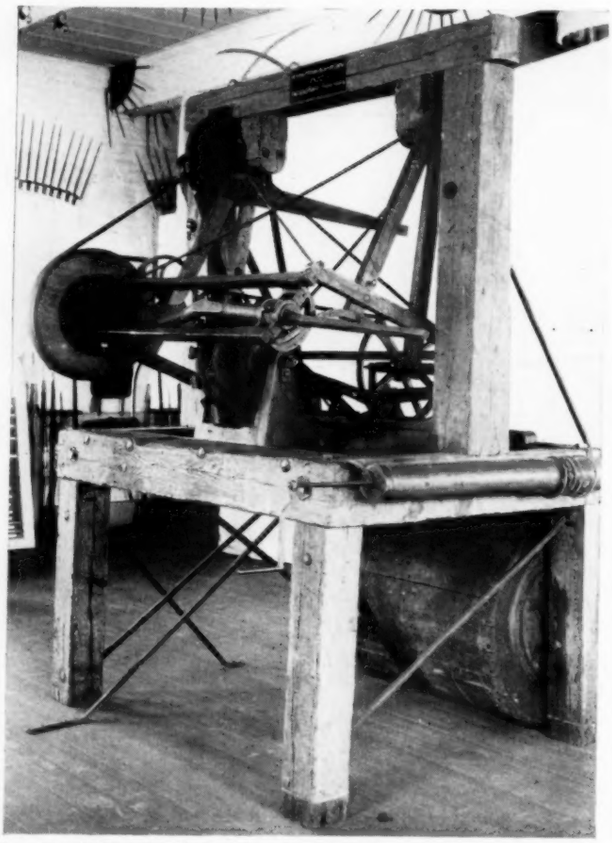
# Early History of American Ordnance

## *A Chronology of Munitions Supply in the United States, Part II*

By Brig. Gen. William H. Tschappat*

ABOUT this time (1812 [1]) a development of small arms took place which seems to have been much in advance of that of arms then in common use. I refer to the development of the Hall rifle.

Shortly after Springfield Armory was taken over by the United States, another act of Congress was passed as a result of which another armory was established. The site selected was at Harper's Ferry, Virginia, and appears to have been chosen by President Washington himself. One can conjecture that the selection was influenced by the fact that Springfield was in the North and Harper's Ferry in the South. Also, it was located conveniently to the then frontier and directly on the main route from the territory south of Mason and Dixon's line to the west. The unfortunate location of this site with respect to the belligerent parties in the Civil War caused its disappearance early in 1861, but during its brief history it appears to have contributed more aggressively to the advancement of the art than did its older contemporary. That this was the case is due chiefly to the influence of one man, Captain John H. Hall.



**Gun Stock Turning Lathe Invented by Thomas Blanchard in 1822.**

Blanchard was a foreman at the Springfield Armory. His invention made possible the production of irregular shapes in wood by machine—a noteworthy contribution to the arts in peace and war.

Captain Hall first came into the small arms picture as the inventor of the first breech-loading small arm patented in the United States. His patent is dated May 21, 1811, and his weapon was the first breech loader to receive consideration from the United States Government. Official records indicate that in January, 1817, one hundred of these arms were ordered. When made they were issued to a company of riflemen by way of experiment and were reported on favorably. The breech of Hall's arm consisted of a block, pivoted at the rear, which carried the flash pan and hammer, and into which the cartridge was pushed from the front. The block was then depressed and caught by a spring catch.

As a result of the test of Hall's weapon, a contract was made for the manufacture of 1,000 at Harper's Ferry and Captain Hall was employed as assistant armorer to supervise their manufacture. Successive contracts for Hall rifles and carbines were entered into and Mr. Hall remained at Harper's Ferry until his death in 1841. In a report made in 1842, the Chief of Ordnance stated that a total of 25,500 of his rifles and 13,684 of his carbines had been manufactured. In spite of the fact that, judging from the number made, his system seems to have been very popular with the Army, its manufacture appears strangely to have died out soon after Hall's death.

Another matter which appears very strange at the present time is the degree of independence which appears to have obtained between Springfield and Harper's Ferry. For instance, Hall made both rifles and muskets of caliber .54, although Springfield held to the caliber .69. Hall applied the percussion lock as early as 1832, while Springfield retained the flint lock until 1842. This differenec, in practice, however, is no more strange than the fact that Hall himself, at that time probably the world's leading exponent of interchangeable manufacture, carried interchangeability into the parts of the weapon but did not carry interchangeability into the product itself. His rifle was of caliber .54, his carbine of .52. Perhaps the matter of standardization did not much appeal to a generation which could while away its time around the campfire by casting its own bullets to fit its own individual rifles. Support, at least, is lent to this view by the fact that a contemporaneous carbine made by Simeon North, at Middletown, Connecticut, was of neither caliber .54 nor .52, but of .51½.

IT is certain that in the decade 1790-1800 both Eli Whitney and Simeon North were making muskets and pistols for the United States which were required by the contracts to be

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1 Editor's Note—In the concluding paragraph of Part I of this article (May-June issue, Vol XIII, No. 78, page 338) reference was made to the organization of the Ordnance Department under the Act of February 8, 1815. The statement as published: "The Ordnance Department operated under the above Act until 1921," etc., is typographically in error, the year 1821 being correct.

**Percussion Rifle and Carbines of the Hall Period.**

Top: smooth-bore carbine cal. .32 made at Harper's Ferry, 1842; second: rifled carbine cal. .51½, made by Simeon North, Middletown, Connecticut, 1834; third: breech-loading smooth bore carbine cal. .54 with rod bayonet; bottom: breech-loading smooth bore carbine cal. .52 made by Simeon North, 1846.

interchangeable. Captain Hall, at Harper's Ferry, brought this art to still greater perfection. He not only made his weapons interchangeable, but he devised and perfected new methods of manufacture and new machinery to make his parts with all the enthusiasm and engineering instinct of the modern automotive engineer. The following extract from a report of a Board of Officers referring to Hall's machinery for the production of small arms, made in 1827, would have reflected credit on Captain Hall, if made in 1927:

"Their 'general merits or demerits, when contrasted with the several machines hitherto in general use for the manufacture of small arms' will, perhaps, be better understood by pointing out the difference of the results produced by them than by any very accurate description of the machines we are able at present to give, although we shall advert to that subject before we close our report. It is well known, we believe, that arms have never yet been made so exactly similar to each other by any other process as to require no marking of the several parts and so that those parts on being changed would suit equally well when applied to every other arm. But the machines we have examined effect this with a certainty and precision we should not have believed till we witnessed the operations. To determine this point and test their uniformity beyond all controversy, we requested Colonel Lee, superintendent of the United States armory at this place, to send to Hall's armory five boxes containing 100 rifles manufactured by him in 1824, and which had been in the arsenal since that period. We then directed two of his workmen to strip off the work from the stocks of the whole 100, and also to take to pieces the several parts of the receivers, so called, and scatter them promiscuously over a large joiner's work bench. One hundred stocks were then brought from Hall's armory which had been just finished, and on which no work or mounting had ever been put. The workmen then commenced putting the work taken from off the stocks brought from the United States armory onto the 100 new stocks, the work having been repeatedly mixed and changed by us and the workmen also. All this was done in our presence, and the arms, as fast as they were put together, were handed to us and minutely examined. We were unable to discover any inaccuracy in any of their parts fitting each other, and are fully persuaded that the parts fitted, after all the changes they must have undergone by the workmen, as well as those made designedly by us in the course of two or three days, with as much accuracy and correctness as they did when on the stocks to which they originally belonged. If uniformity, therefore, in the component parts of small arms is an important desideratum (which we presume will not be doubted by anyone the least conversant with the subject), it is in our opinion completely accomplished by the plan which Hall has carried into effect. By no other process known to us (and we have seen most, if not all, that are in use in the U. S.), could arms be made so exactly alike as to interchange and require no marks on the different parts, and we very much doubt whether the best workmen that may be selected from any armory, with the aid of the best machines in use elsewhere, could, in a whole life, make a hundred rifles or muskets that would, after being promiscuously mixed together, fit each other with that exact nicety that is to be found in those manufactured by Hall."

ONE very noteworthy contribution to the arts of peace as well as of war was made at Springfield Armory in 1822. Thomas Blanchard, a foreman at the armory, brought out his lathe for the turning of irregular shapes in wood. By its use the work of producing a gun stock was made a machine

**The Upper Water Shops at Springfield Armory in 1830.**

In the early group of buildings comprising the Water Shops at Springfield Armory authorized under the Act of Congress of 1794, there were three groups known as the Upper, Lower and Middle Water Shops. Until 1834 they were in operation utilizing the water power of the Mill River in its descent to the Connecticut to furnish mechanical power necessary for operating forges and smelting furnaces and for driving the machinery in the Armory.

instead of a hand process. This machine is in current industrial use for making shoe lasts and similar irregularly shaped articles. Both the work and a model are made to rotate at the same speed on parallel axes. A wheel rolling on the model controls the position of a circular cutter of the same diameter through a system of linkages so that the relation of the cutter to the work always corresponds to that of the rolling wheel with respect to the model.

The other significant development in small arms during this period was that of the percussion primer which resulted in the supercession of the old flint-lock by the much more convenient and reliable percussion system. The first step towards this development was made by the Rev. Alexander James Forsyth, a Scotch divine who for fifty-two years was a minister of Belhelvie, Aberdeenshire. Mr. Forsyth started his experiments as early as 1793 and by 1805 had successfully applied his ideas to a fowling piece. He used a mixture of chlorate of potash, sulphur and charcoal and appears to have fired the mixture by placing a small quantity in the bottom of a hole which communicated with the main charge in the gun. A plunger in this hole rested on the priming composition. The upper end of this plunger was struck by the hammer when the trigger was pulled and the blow of the plunger on the composition set it off. He perfected the details of his system and in 1807 claimed that "the Forsyth patent gun-lock is entirely different from the common gun-lock. It produces inflammation by means of percussion, and supercedes the use of flint. Its principal advantages are the rapid and complete inflammation of the whole charge of gunpowder in the chamber of the barrel, the prevention of the loss of force through the touch-hole, perfect security against rain or damp in the priming, no flash from the pan and less risk of accidental discharge of the piece." Forsyth's invention, however, needed further development to make it entirely practicable. The use of a detonating material in bulk, even if the bulk be small, has manifest disadvantages and numerous attempts were made to overcome this difficulty.

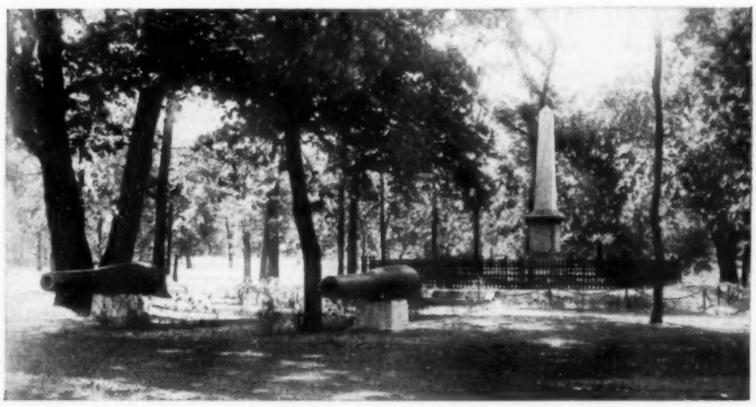
To Joshua Shaw, of Philadelphia, is due the credit for the next step. He first, in 1814, introduced a small steel cap in which he put a small quantity of fulminate of mercury. This was a friction fit on the end of a small hollow tube or nipple which communicated with the main charge. When the hammer struck the cap the fulminate was caught between the cap and the nipple and exploded by percussion. The flash passed through the hollow nipple to the black powder in the chamber and thus discharged the piece.

Shaw used steel caps with the idea of saving and reloading them. The next year he substituted pewter for steel and abandoned the idea of reloading. In 1816 he introduced the copper cap and made the final step in a development which held the field until finally driven out by the introduction of the breech-loader.

AS has been noted above, the percussion lock was introduced by Hall at Harper's Ferry as early as 1832 and at Springfield in 1842 but even Captain Hall's delay of some fifteen years in the use of what seems too obvious an improvement is difficult to explain at this late date. The United States, be it noted, was not alone in the slowness with which the military authorities took up the idea. The British tried out the percussion principle at Woolwich in 1834 by firing 6,000 rounds from six flint-lock muskets and a similar number from six percussion lock muskets in all kinds of weather. The shooting with the percussion lock was found to be more accurate, the recoil less (the charge being reduced from 6 to 4½ drs.) and the rapidity of fire greater. The number of misfires

was 1 to 26 in favor of the new lock. As a result of the great superiority of the percussion system, they changed over their manufacture three years later. The Austrians made the change in 1840.

Captain Hall was again the pioneer in introducing the rifle. Apparently the 100 pieces ordered from him in 1817 were rifles and, although he produced some smooth bore muskets, the bulk of his guns appear to have been rifles. Springfield changed over to the rifle in 1855 and with it adopted an elongated bullet of 550 grains and reduced the caliber to .58. Externally, however, the weapon had the same general appearance of the original flint-lock musket copied from the French model of 1763.



**The Grave of General Rodman at Rock Island Arsenal.**

General Rodman introduced the method of gun fabrication which bears his name and is still used in modified form. He was also the inventor of the first reliable pressure gage for use in cannon. He was in command of the Rock Island Arsenal from 1865 to 1871.

Captain Hall's weapon had the great advantage of being a breech loader. Hence a ball of sufficient size to "take the rifling" could be easily introduced. In the case of muzzle loading rifles, some method of expanding the bullet had to be devised. One method was to have a pin or spindle in the bottom of the bore so that the bullet came to rest against the end of the pin. A few blows with a heavy ramrod would deform the lead bullet and force it into the rifling. The gun was very difficult to clean, there was no uniformity in the blows struck and the method, consequently, was not very satisfactory.

Colonel Minnié introduced a lead bullet with conical cavity in its base. A cup of sheet iron was inserted at the base so that the effect of the powder gas pressure was to drive the sheet iron cup into the cavity and thus expand the bullet. Unfortunately, the cup would sometimes be driven entirely through the lead bullet so that an irregular lead cylinder would be left in the bore after firing.

The United States adopted a bullet somewhat like the Minnié, but without the sheet iron cup. A conical cavity in the base supplied for the action of the gas to expand the bullet so that it took the rifling properly. This change came in with the rifle in 1855 so that an elongated bullet of about 13 to the pound superseded the old caliber .69 musket with 17 round bullets to the pound and Hall's breech loader of caliber .54 with 32 to the pound. The term superseded is to be understood as for manufacture only. Many of the old guns still remained in service as will appear when we come to study the Civil War period. The model 1855 Springfield was the standard Springfield throughout the Civil War.

Although Hall's rifle ceased to be produced almost with his death in 1841, the basic idea was not dropped by inventors and new breech-loading systems were appearing from time to time. Sharp's breech loader, using a paper cartridge and a separate percussion cap, was brought out in 1857. It had a sliding block operated by a lever under the barrel. The block sheared off the end of the paper cartridge so that the flame of the cap could reach the powder.

GOING back to the question of organization, we find in the Act of March 2, 1821, this provision:

"Sec. 4. That the Ordnance Department shall be merged in the artillery; and that the President of the United States be, and he is hereby, authorized to select from the regiments of artillery such officers as may be necessary to perform ordnance duties, who, while so detached, shall receive the pay and emoluments now received by ordnance officers, and shall be subject only to the orders of the War Department; and that the number of enlisted men in the Ordnance Department be reduced to fifty-six."

This Act was, insofar as the functioning of the Ordnance Department is concerned, a reversion to what had been the practice during the War of the Revolution in the organization for ordnance work in the field army. As I have indicated previously, ordnance work for the country as a whole during the War of the Revolution was controlled as to its procurement and largely as to its design by an organization having its head at the seat of government, but in the latter part of the war the head of Ordnance activities with the army in the field was an artillery officer. The Act which I cited went farther than this and placed all the activities of the Ordnance Department in the hands of artillery officers.

This Act, however, made no change in duties of the Ordnance Department; it simply provided that these duties should be performed by officers detached from the Artillery and placed directly under the War Department for the purpose of performing these duties. The permanent Ordnance officers were largely retained in the organization and Artillery officers were detailed to fill vacancies, including that of Chief of the Department. This type of organization lasted eleven years, until it was repealed by the Act of April 5, 1832, which placed the Ordnance Department back on a permanent basis, insofar as its commissioned officers were concerned. Eleven years' trial of this system proved it to be entirely unsatisfactory, largely due to the fact that officers were detailed on this duty for one year at a time and then were required to serve four years with the Artillery. The single year's detail was not sufficient to make them at all familiar with the multitudinous duties connected with the administration of ordnance.

The reversion of the organization back to that of 1815 marks what may be considered the beginning of a new epoch in the history of the Department. While this general organization remained about the same from 1832 to the beginning of the World War, we may well consider the history of the Department since 1832 divided into the period governed mainly by the two great conflicts which took place since then. The effect of a war on ordnance development is not as a rule immediate but lasts for many years after the conflict. The

period from 1832 to the Civil War is marked by slow but sure progress in small arms and cannon development. I have already mentioned the development of the percussion cap.

The Mexican War was fought by the Regular Army alone and the supply of ordnance matériel throughout the conflict appears to have been ample. There was increased activity at the arsenals and armories of which there were then eighteen, and orders for certain types of munitions were placed with private manufacturers. The Chief of Ordnance was authorized to enlist additional artificers and other mechanics as needed and a small increase in the commissioned personnel of the Department was authorized, but no reorganization or rearrangement of the duties of the Department was put into effect.

The Chief of Ordnance had direct control of the manufacturing arsenals and armories and of the many issue and repair depots away from the theater of operations. The Commanding General of the Armies had full charge of all personnel and matériel with the army. Army depots were established in charge of Ordnance officers at Corpus Christi and Point Isabel, Texas.

As to artillery developments during this period, we may assume that the artillery procured during the Revolution was largely of British origin, although, as I have mentioned before, guns of French construction were procured during that struggle. In the year succeeding the Revolution and up until 1830 or later there was a great deal of discussion of the two outstanding systems of artillery as to which should be adopted for our service. The systems which came into this discussion were the English system and the French or Gribeauval system. Insofar as the construction of the gun carriage itself was concerned, the main difference seemed to be that the English system had a box or single trail with the trunnion seats in separate cheeks or side pieces attached to the trail; while in the French system the trail was composed of two cheeks holding the trunnion beds, the cheeks being held together by brackets. Also in the French system for mobile artillery the wheels of the limber were twelve inches smaller in diameter than those of the carriage proper, while in the English system the wheels of the limber and carriage were of the same diameter. Both these systems, particularly the French, by 1801 had been very completely worked out for all sizes of artillery. Beginning in that year and between that and 1810 the Gribeauval system was adopted in all its essential elements for the United States service. The War of 1812 was fought with that system insofar as new matériel used is concerned. It also brought out some of its defects in comparison with the artillery of the British system to which it was opposed. Almost immediately following that war investigations were made of the advantages of the British block trail system but it was not until 1830, after the French had already adopted a system practically identical with the British, that steps were actually taken to change back to the British system.

The development of cannon during this period was very slow. Guns used by Napoleon in the streets of Paris in 1795 could have rendered effective service at Gettysburg in 1863. The typical cannon of the time came very near to being that of the Irishman's specification: A large sized hole with a piece of iron around it. With a touch hole at the rear end and a couple of trunnions along the side so that it could be rigidly attached to the carriage, the gun was complete. Projectiles were the round shot; cast hollow with a black powder bursting charge ignited by a fuze train; the round shrapnel introduced about the turn of the century and containing a number of lead balls with a black powder bursting charge; the grape and the canister which were broken up by the shock of discharge so as to give very effective results at point blank range.

Guns were of varying calibers from 3 inches to 18 inches and of varying lengths with respect to their calibers so that there were guns, howitzers, columbiads, mortars, etc.

The desirability of the rifled piece was well understood but the difficulty of imparting spin to a heavy projectile loaded from the muzzle offered great difficulties. Many devices were tried and it was toward the end of the period that Whitworth brought out one of the most successful of the muzzle-loading, rifled cannon. This had a bore of hexagonal section made with a twist and the projectile was of similar section with a similar twist. We will hear more of this piece in connection with the Civil War.

There was a tendency toward the elimination of ornamentation from cannon. No longer were carved figures, coats of arms, mottoes, etc., placed on guns although as late as the Mexican War a captured piece bore the title of "El Terror del Norte Americano."

Captain (later General) Rodman introduced an entirely new idea into the fabrication of cannon and one which, in a modified form, is still used in the construction of all large caliber ordnance. His idea was this: Since cast iron contracts in cooling from the molten state so that a gun cooled from the outside would have initial stresses in it which acted in the same direction as those set up by the powder gas pressure on firing, by reversing the process and cooling the piece from the inside, he would have a gun in which the initial stresses acted in a direction opposite to those set up by the gas pressure. That is, the metal at the surface of the bore would be compressed by the later cooling of the outer metal. The powder gas first would have to overcome this initial compression so that the total tension set up on firing would be correspondingly reduced. Rodman's guns were famous in their day and the same initial compression of the metal at the surface of the bore is required in modern guns although obtained by other methods.

Captain Rodman was also the original inventor of the pressure gage as used in cannon. The original Rodman gage was the first which really gave reliable comparative records of pressure in guns. This work, which was done at Watertown Arsenal in the decade preceding the Civil War, at once attracted wide attention in Europe. His work was not limited to these two developments, but he interested himself in the problem of providing more satisfactory powder for cannon. His work in forming black or brown powder into grains of a regular form and so shaped as to give a constant or increasing burning surface in the charge is the forerunner of the adaptation of powder granulation to cannon of the present day.

In the next, the concluding, article of this outline history of the Ordnance Department of the United States Army, the two great periods of the American Civil War and the World War will be discussed. It is the author's hope that the series will result eventually in a complete definitive history of the Department only the highlights of which are recounted here. (*To be concluded in the September-October issue.*)

# Defense Against the Hedgehopper

## *How Shall the Low-Flying Attack on Ground Troups be Met?*

**A Symposium**

THE World War necessitated the introduction into warfare of many devices created by the scientific age in which we live. The applications, as a rule, have for their purpose improvement in the effectiveness of military offense. In turn each new offensive device immediately creates the problem of developing adequate means of defense against the attack. The offensive power of implements of warfare is always a hazard until there is discovered and applied some means of efficiently neutralizing the effective value.

By general agreement, we believe, a review of the best of new offensive weapons of the World War places the airplane as the most important machine of all introduced in that conflict. At first the airplane was comparatively harmless; it was generally restricted to reconnoitering. It was not long, however, before the airplane began to take on a more formidable aspect. As an outgrowth of the observation plane there developed the pursuit type which had as its mission an aërial attack for the purpose of destroying the observation plane. Finally there appeared the bombing plane which at the close of the war was considered the most dangerous of all because of its ability to render destructive fire upon ground targets; not only in the immediate vicinity of the theater of operation but also far back in the zone of communication.

The combating nations were faced with a stupendous task; namely, the development of antiaircraft defense against this evasive machine of destruction. After many years of research and development what is considered to be an adequate—indeed a highly effective—defensive system for use against the bombing plane has been evolved. Meantime airplane development has not stood still.

Planes have been designed and perfected with even greater speeds and pilots have been trained to fly these planes with increasingly remarkable skill. As a result there has come into existence a condition as serious to the safety of ground personnel and equipment as has ever been known in warfare; that is, the hedgehopping attack upon columns on the march by light attack planes equipped with machine guns and light bombs.

What shall be the defense against the hedgehopping attack plane flying at high speeds along the length of the column and spraying destructive machine gun fire in its path?

For the purpose of stimulating interest in this all important problem and thus bringing forth what may be the most effective solution, the Editor submitted this question to a selected number of officers of the several branches of the Army for discussion. Solely in the spirit of helpful analysis the following contributions to this study are published. It is hoped that other contributions will be available for use in succeeding issues of this Journal.—*Editor.*

### THE CAVALRY DEFENSE

*By Maj. Kenna G. Eastham, Cavalry*

THE Cavalry is studying methods, developing weapons, and conducting experiments and tests designed to make the attack against ground troops by low flying planes a dangerous, hazardous, unsuccessful and unprofitable undertaking. The airman seeks profitable targets and bases his tactics on the element of surprise. The Cavalry meets these efforts by offering targets which are both unprofitable and dangerous. It minimizes the element of surprise through the employment of effective security measures.

Air attacks may have to be met during combat, in bivouac, and on the march. An air attack during close combat between ground troops can hardly be classified as hedgehopping. It will be met by instant fire from the ground troops who will be, at the time, in position to train their weapons on the planes. The bivouac defense includes the taking advantage of such cover as the ground affords, the special sitting of automatic weapons for fire against attacking planes, and provisions for observing the approach of planes and the prompt alerting of the command. The greatest danger from hedgehopping planes is while the command is on the march. On such occasions warning of the approach of the planes having been received from the security groups, the attack is met by *fire,* and *not by dispersion.*

*Dispersion* is a negative measure even when effective. It causes delay to the column. It permits the airman to repeat the attack. It frequently affords a better target for formation attack than nondispersion. It is indecisive. It does not build up morale nor create confidence as to the ability of the ground troops to combat planes flying at low altitudes. Slight dispersion is advisable so that every trooper may use his rifle without endangering his comrades, but dispersion with the idea of getting out of the way of the plane, and the consequent loss of time and control, is not to be permitted.

*Fire* when effective, is decisive. It terminates the threat. It creates confidence and high morale. It entails a minimum loss of time. The chief reliance is placed in fire alone.

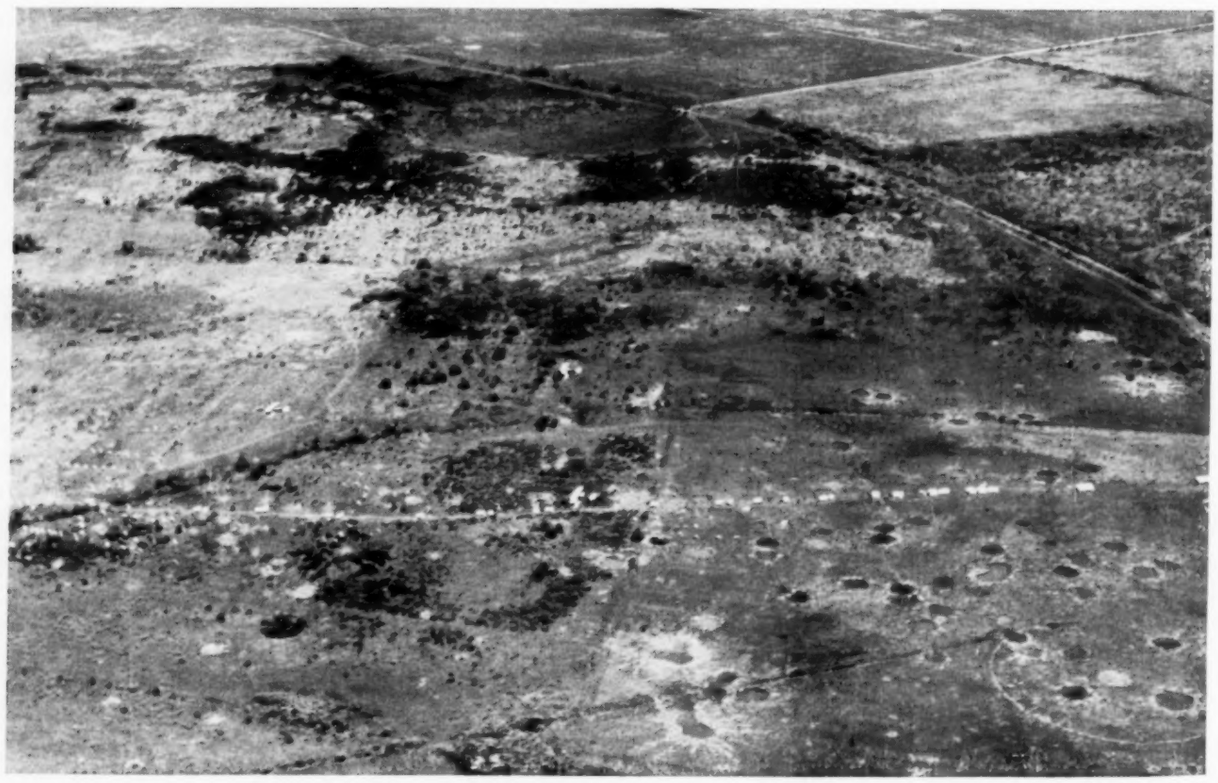
Tests by the Cavalry have created a decided confidence in the individual soldier in his ability to defend himself against such attacks. The Chief of Infantry, in the March-April, 1933, *Infantry Journal,* states: "Experimentation at the Infantry School and tests by regiments are convincing that ground troops can effectively combat low-flying aircraft by the use of rifles, automatic rifles, and machine guns. In fact, we believe that the chances of success in an engagement between Infantry soldiers and attacking airplanes are in favor of the ground troops." If the moral is to the physical as three to one, such confidence will be a vital asset in war.

The Cavalry seeks its protection against attack planes by the following means: 1. Use of air scouts to give timely warning of the approach of the planes. 2. Use of air observers (with the column) instantly to inform the command of the signal sent by the air scouts. This relieves the entire command from the fatiguing duty of remaining constantly on the alert. 3. Use of cover en route and at the halt for concealment from view of hostile observation planes. 4. Providing security measures in advance at favorable places for the attack. 5. Taking advantage of darkness or weather conditions unfavorable for flying. 6. *Prompt and maximum fire when the attack is launched.*

The attack having been launched, success depends upon

# *The Low Altitude Air Attack*

**An Air Squadron Emerging From a Smoke Screen for the Attack.** *Air Corps Photo*



**A Battalion of Infantry Under Attack by an Air Squadron.** *Air Corps Photo*

getting the command alerted by the time the plane is within effective range. That means that adequate measures must be adopted to alert the command. This is obtained through the employment of air scouts and air observers. Routine training in this work is required as is the case in antiaircraft firing.

In the scheme, then, of protection by fire against aircraft the warning signal of the *approach* of the attack becomes the vital factor. Rifle shots, arm signals, whistles and voice have been tried, and generally found inadequate. A small, cheap, simple smoke grenade which can be issued in quantity to air scouts and to men at intervals in the column has been tested and found to meet requirements. It bursts at a height of thirty feet in the air and its cloud is readily observable at distances up to, and even beyond, one mile.

WHEN a Cavalry command starts out on a mission, security measures are habitually taken against enemy attack aviation. The first warning of the attack to be received will be the specific one given the column by the air scout. In a very few seconds after receipt of this warning, half the rifle strength of the column can be dismounted, ready to fire. Experiments indicate that the warning will usually be received well before the plane appears over the target. The air scout has no other function than observation for air attacks. Notwithstanding the facts that any large body of Cavalry will usually have other arms (air corps or antiaircraft units) to assist in its protection from air attacks, and that hedgehopping planes are unlikely to attack small bodies of Cavalry, the Cavalry must always be prepared to provide for its own aërial security. Air scouts must always cover the front, flanks and rear of a unit no matter what formation the unit may adopt or whether it is moving or stationary.

The air scout is instructed to be particularly alert in cloudy weather when the ceiling is low. He is especially alert against attack coming straight out of the sun. Hills are carefully watched. Planes high overhead are kept track of lest they gradually drop down into position for the attack. Connecting files are used so that the air scout is always in communication with the air observer. Normally, air scouts operate in pairs, one observing for planes while the other watches for signals from the command. Every man in the command is trained and available for air scout duty just as he is for security duty of other sorts.

Upon receipt of a signal from an air scout and its announcement by the air observer, the troopers at once dismount and step aside slightly so as to be free to use their weapons. Experiments have shown that with timely warning each man can normally get in from three to five aimed shots while the plane is within range. The important things are that the air scout be alert enough to discover the plane, that he has the means of transmitting a signal to that effect to the command, and that the observer with the command receives the signal and can notify the command instantly. No time is lost in an effort to seek safety through dispersion. Fire is the all important consideration. Well trained fire will cause enemy aircraft to have a high regard for the capabilities of ground troops in their defense against low-flying aircraft.

TRAINING in antiaircraft firing should be incorporated as an essential part of target practice and should be patterned on the same fundamental system as the ground target course, including marksmanship, musketry, and combat practice. At the close of the World War the European powers believed that low-flying aircraft operating against ground troops would greatly simplify the military problems within their colonial and mandated possessions. Results in India, Syria, and Morocco have fallen short of expectations in this regard. Bombing attacks have scattered and demoralized green troops but generally the actual number of casualties has been small, and, after the initial awe and mystery were removed, the effects on the hostile natives have not been material. A study of these operations indicates that training in accustoming *any* troops to the uproar of air attack should be made mandatory, such training to include simulated air attacks with the planes dropping harmless, noise-producing mobs in the safe vicinity of ground troops. Cavalry horses, as well as the men, can be readily accustomed to this sort of thing.

As a brief summary, it may be said that the Cavalry defense against hedgehopping planes is based upon the principle of security and the principle of the offensive. The former is manifested by the employment of agencies to give timely warning of the attack while the latter is indicated by the training policy that *aggressive fire is the habitual defense,* and that when the plane approaches within range everything else is subordinated thereto.

When these principles are understood and properly applied, the low-flying attack plane will soon become wary of the soldier on the ground if he has a rifle in his hand.

## IMPROVISED METHODS OF THE FIRST CAVALRY DIVISION

*By Maj. John H. Woodberry, Ordnance*

LOW-FLYING hostile attack airplanes are a menace which must be reckoned with in all echelons of command. The army or corps may provide general zone defense in stabilized positions, but in open warfare troops and other elements of the division cannot rely solely on the higher command for protection. They must be provided with local means of defense. This is especially true of cavalry which operates, generally, without supporting troops. Friendly aviation may offer a measure of defense, but divisional units must be prepared for surprise attacks by airplanes which may filter through the general aërial defense. Tables of Organization and Tables of Basic Allowances for a cavalry division are noticeably silent on antiaircraft defense, and War Department publications are all too quiet on the subject.

In considering this subject from a division standpoint, the characteristics of modern attack aviation have been kept uppermost in mind. Exceedingly high speed, smallness, and low visibility of the target, and the tremendous fire power of these planes are matters to be dealt with in determining defense against their attack. No system of defense which depends upon preparing for action after they have been sighted by troops can be effective. Nor can a system which relies entirely upon the fire power of the unit being attacked be called effective. There must be two factors in the defense: warning means, and means for breaking-up the attack before it reaches the target.

The solution as worked out in the First Cavalry Division involves the establishment of a division zone defense sufficiently remote from the elements of the commaand to warn of the approach of attack aviation, and organized with personnel and equipment in positions of readiness, to break up the attack before it reaches its objective. In short, the division marches through and bivouacs in a defended zone. There should be, of course, within each organization means for affording local defense against planes which may break through the zone defense, but this resistance may be considered supplementary to that furnished by the zone defense.

Brig. Gen. Walter C. Short, who has from time to time commanded the First Cavalry Division, has considered this subject with much concern, and through facilities available to him has sought and found means which, though improvised, have added to the antiaircraft defense measures of

**Fig. 1. Triple Machine Guns on Three-Wheel Trailer, Forerunner of Cross-Country Light Antiaircraft Vehicle.**

the Division from a standpoint of matériel, and crystallized within the Division a line of thought to govern future development. This article deals with developments made under his direction and the principles evolved.

THE establishment of a mobile zone defense hinges on the development of mobile antiaircraft vehicles which may move with certainty and rapidity across country. Until recently this requirement was thought impossible of attainment. Lately, however, experiments in the First Cavalry Division have shown that with low pressure balloon tires on light vehicles, surprising cross-country mobility is attainable, and it is now considered that the mobile zone defense is feasible. Mounted on suitable cross-country vehicles, multiple guns, operated by single operators, offer maximum antiaircraft defense with the minimum personnel. Experiments are now in progress in the development of this type of vehicle. (Fig. 1.)

In organizing the zone defense system, there should be provided a distinct antiaircraft unit, consisting of personnel and equipment to be used solely for this purpose. Such an organization should have for its mission the setting-up of a continuing protected avenue through which a column may march in relative safety. By occupying successive positions on the flanks of the column with a sufficient number of mobile antiaircraft vehicles, overlapping zones of fire throughout the length of the column are set-up through which planes will find it impossible or unprofitable to penetrate. As the tail of the column approaches the rear of the defended zone, the rear antiaircraft vehicles will bound forward to other positions beyond the head of the column, thus providing a continuous protected zone for troops and trains. Likewise, in stabilized positions, through suitable distribution in the rear and on flanks of the command, antiaircraft protection using suitable vehicles and weapons can be furnished troops in battle.

The organization arms of combat troops and such special weapons as may be issued to trains and artillery constitute the auxilliary defense. In the First Cavalry Division the main problem concerning these weapons has been to obtain machine gun mounts suitable for high-angle fire. None of the issue mounts are entirely suitable for this purpose. However, through experimental manufacture, mounts have been provided in the First Cavalry Division for all types of automatic arms, which enables their employment for this purpose.

SUPPLEMENTING the zone defense, it has been accepted as a likely hypothesis that rifle and machine gun troops can, in general, render self-protection, using their organization weapons. Rifles and pistols, through proven tests in the Army, are known to be among the most effective weapons to combat low-flying aircraft. The caliber .30 machine gun is also recognized as a powerful antiaircraft weapon, demoralizing as well as destructive. With concise and intensive instruction in the use of these weapons against aërial targets, it has been demonstrated that a sufficient number of hits can be registered on low-flying targets to disable them.

Recently a modification designed by Capt. Thomas J. Heavey, Cavalry, whereby water-cooled machine guns may be used on the machine gun mount M1917 with some degree of success, has been authorized. The First Cavalry Division is equipped with weapons so modified. (Fig. 2.)

But the weapon offering the greatest fire power in the Cavalry, namely the air-cooled machine gun (six authorized per rifle troop), is not equipped, when issued, with mounts permitting high-angle fire. It is this condition which represented the unsolved part of the close-in antiaircraft defense of rifle troops.

Much thought and experiment has been spent in devising means to put the air-cooled guns into antiaircraft action. The result has been the development of an attachment to the front leg of the locally manufactured ground mount used with this weapon whereby an ordinary rifle might be instantly

**Fig. 2. Water-Cooled Machine Gun in Antiaircraft Position on M1917 Tripod.**

inserted, raising the weapon to a height permitting fire at almost vertical angles, through an arc of about 180 degrees. A considerable amount of firing at aërial targets has been done with this mount, with results highly pleasing. All

mounts in the four regiments of the Cavalry Division have been thus equipped. (Fig. 3.)

It is not anticipated that cavalry troops on the march will be able, on the sudden appearance of hostile attack planes, to unpack and place machine guns in action. Rifles and pistols must be used in such cases. However, on battle positions, in bivouac areas, and as flank protection the machine guns will be of great importance in antiaircraft defense.

It is considered that the problem of local antiaircraft defense in the four regiments of the Cavalry Division has been met as well as expedients outlined above permit. The remaining problem is one of improvement in machine gun matériel, including mounts, by the Ordnance Department.

BY far the most vulnerable targets in a division are the wheeled elements, particularly when road bound. These units are by nature practically defenseless against attack planes. Truck trains, wagon trains, regimental transport trains, and artillery are included in the category. They cannot readily disperse and are not equipped organically with sufficient fire power to offer any appreciable resistance against either ground or air attack. Usually, they operate outside the protection of front line elements, and are but incidentally protected by the defense system of higher units. Within the past few months,

**Fig. 3. Air-Cooled Machine Gun on Fort Bliss Tripod Mount in Antiaircraft Position, Using Rifle for Third Leg.**

wagon trains of the First Cavalry Division have been provided with some light air-cooled machine guns, and the artillery with automatic rifles. The trains, however, were not issued mounts which permit the use of the machine guns in high-angle fire. The artillery plans to use the automatic rifles fired from the shoulder.

It has been demonstrated that machine gun fire from a moving wagon is valueless. This eliminated the use of the much over-worked "pipe mount" attached to wagon bodies. Yet, there is distinct advantage in having machine guns on vehicles, particularly wagons, as wagons are frequently called upon to move in small detachments in unprotected areas. When assembled in convoy, the aggregate number of guns offers excellent means of defense. To meet this need of highly mobile air-cooled machine guns capable of high-angle fire, there has been developed at Fort Bliss a "ball and socket" mount for air-cooled machine guns which may be operated instantly from the tops of wagon loads, or from the ground, and may be fired at either ground or air targets. This mount meets reasonably well this part of the problem of local anti-aircraft defense of wagon trains. With six or eight of these weapons per wagon company, it should be difficult for aviation which may filter through the zone defense to attack a wagon train successfully. (Fig. 4.)

Truck trains are in a category similar to that of wagon trains, but vary enough to warrant a different means of

**Fig. 4. Air-Cooled Machine Gun on "Ball and Socket" Mount.**

defense. The speed and stability of trucks make the use of machine guns mounted thereon practical. The "ball and socket" mount would be equally adaptable to truck trains, but experience has shown that greater and more effective fire power with less personnel can be developed on trucks if equipped with mounts providing multiple guns. In conducting experiments with trucks, the First Cavalry Division has developed a swivel chair mount, carrying three guns, fired by a single operator. The chair is mounted on a skeleton frame over the radiator, in extension of and above the height of the cab, on trucks which move at the head, center, and tail of the

**Fig. 5. Chair Mount With Three Air-Cooled Machine Guns in Parallel.**

column. These guns afford protection on the march and in the train park, utilizing but one man per three guns. The defect in this system is that flank protection cannot be obtained on the march unless the much looked for, but seldom occurring, parallel roads are to be found. (Fig. 5.)

While the experiments above outlined have not yet been tested sufficiently to warrant definite conclusions on the ultimate solution of this problem, it is felt that a material advance in the organization of antiaircraft defense measures has been made in the First Cavalry Division and that our experimental work is proceeding along proper lines.

### A Field Artillery Viewpoint

*Maj. Louis E. Hibbs, Field Artillery*

THE attack plane is a weapon offering the ability to strike quickly and powerfully, though locally, and at a great distance from its base. It is not capable of powerful sustained offense though it may strike frequently. Its use for the attack of ground troops is expensive in planes and in the expense of their operation; while so engaged it is withdrawn from availability as a protection for the bombardment. Its use against ground troops may therefore be expected only when its employment may definitely be considered profitable and when the result can be obtained by no other less expensive means.

Lack of ability for sustained effort restricts the results of successful attack to delaying and hampering the movement of ground troops; a determined enemy in number warranting his attack by low-flying planes, will not be stopped or destroyed by air attack, any more than he has been stopped or destroyed in the past by artillery fire. Contrary opinion in this respect must be based upon the supposition of such a volume of fire power as cannot reasonably be expected to be available to the attacker when the number of planes and the requisite fields for their operation are considered.

This powerful delaying and disorganizing agent will only be employed after considered thought and in accordance with a definite plan—not as a group of free-lance hedgehoppers attacking any target which may appear. (Barring, of course, occasional independent action of the individual dare-devil who cannot be restrained. Fortunately the latter probably will be self-eliminating.)

The opportunities for the profitable use of the attack plane against ground troops other than the antiaircraft artillery—which latter installations will probably be a routine objective for the purpose of protecting the big brothers of the bombardment—will arise during the critical periods of actions and will be directed against troop movements or concentrations which may affect vitally the outcome of the battle. Generally speaking we may group these opportunities under movements of reserves, concentrations for attack and counterattack, delay of pursuit and disorganization of retreat. Rarely will the attack plane be used on the immediate battlefield against targets which can be taken under artillery fire, excepting possibly as a desperate measure against overwhelming odds.

IN the combat of units of sufficient size to have air units comprising attack planes present with them on the battlefield, the probable use of these attack planes against ground troops should be susceptible of accurate forecast and air observation should be directed to this end. The commander should provide for the utilization of our own air units to the fullest possible extent in order to stop the hostile air attack before it reaches its objective. These measures should include attack and bombardment of enemy landing fields and attack of such enemy planes as take the air. Hostile attack may be expected to take the form of repeated assaults upon our ground troops continued over a relatively long period of time, the attack planes returning to their fields for reservicing. Even if the initial assault is unforeseen the subsequent ones should be prevented by stopping them at their source, the hostile landing fields. This is the first line of defense and it should be provided for in the plan of the commander and should be put into effect to meet the enemy attack. It would be most unfortunate at a critical stage in an action for the decisive blow to fail by reason of delays occasioned by enemy low-flying attack which has been permitted to take the air and to come through unmolested by our own aircraft because our own aircraft have been diverted to some remote or independent mission elsewhere. Vigorous action on the part of our own aircraft should be able to take the sting out of the enemy attack.

A Field Artillery battery in position—unless it be an antiaircraft battery or be mistaken for one—will rarely be attacked by the low-flying plane, since a battery in position is of a low order of vulnerability even when surprised, and since it can be taken under fire much more profitably by the hostile field artillery, or, if of necessity from the air, by the hostile bombardment under protection of pursuit and attack units. A possible exception to this statement may be taken in the matter of the spraying of chemical agents from the low-flying plane: measures to protect against this form of attack are not essentially and peculiarly a Field Artillery problem and are not here discussed. Do not read here a suggestion, or intent, when in position, to rest secure in the belief of immunity from such attack: it is intended to point out, where conflict arises in the matters of design and employment, that it is more important to have our defense adapted to meet attack delivered against us when we are in march formation than to meet that delivered when we are in position. Except for the protection of our animals (particularly mentioned because of their peculiar vulnerability) and our other transport which operates in supply movement while our guns are in position, our defensive means while in position is clearly of secondary importance to that of suitable defensive means while in march formation—whether on or off the road or in bivouac. The defense of Field Artillery units at times other than when in position is the vital problem.

FIELD artillery units must provide their own protection against attack by low-flying aircraft. This is a basic principle, for the regularly organized antiaircraft units will be entirely occupied in providing area defense, particularly against the higher flying aircraft, which, in the case of the antiaircraft artillery, are the only air targets which it may successfully engage. Meager assistance may be expected of our own aircraft in the immediate vicinity once the attack has reached us. We must be prepared to furnish our own defense against such attack, utilizing such weapons as we may provide with our columns.

The attack plane will fly at low altitude (75 to 100 feet) seeking concealment of terrain features until within short range of its target. It will fly at high speed (200 miles per hour or more) and will attack in a single sweep, regaining concealment by terrain features as quickly as possible. During its visible approaching flight it will fire with its forward machine guns (four or more) upon its target and will drop its bombs as it passes overhead. It will rely upon its bombs for its principal effect upon the target and will fire its machine guns principally for the purpose of keeping down the fire of the ground weapons. A plane will rarely return to the attack after having once passed over its target.

The attack plane may sweep a length of 2400 yards with continuous fire from its machine guns; it may effectively cover

an area 30 yards wide and up to 300 yards long with its bombs. The length of the area will be determined by the interval at which the bombs are dropped.

The target will generally be attacked in enfilade though the approaching flight may come in upon the target from an oblique direction. The direction from which approach will be made will generally be from that which is most favorable to protection of the plane, conservation of the surprise element and effective attack of the target. When the sun is shining and low in the heavens this is considered to be a direction from which attack is very likely to approach. When two columns are marching on parallel roads close to each other the direction of approach is likely from the flank which is away from the adjoining column.

A column may be attacked by a trio of planes or by single planes, and may be attacked either from front to rear, or from rear to front, or in both directions simultaneously. Attack by single planes will probably be the usual procedure at night, offering less danger of collision between planes; attack by trios may be expected during daylight as such a formation offers the attacker better protection against hostile aircraft.

Attack with chemical agents sprayed from the plane will pass to windward of the target and will be preceded by some form of attack with fire as protection to the chemical-spraying plane. Smoke may be sprayed prior to the spraying of other chemical agents.

Whether we may expect to be attacked more frequently by day than by night is a question that can only be answered by the time worn statement that it depends upon the situation. Since the majority of our important troop movements will probably be made under cover of darkness, greater opportunity for employment of attack may be argued to exist at night; on the other hand, difficulties attendant upon night flying and discovery of the target at night argue against it. We will certainly be subjected to night attack upon occasion and must be doubly watchful on moonlit and clear starlit nights.

Attack planes may carry some form of light armor covering their vital parts. This contingency should not be overlooked in the design of weapons to be employed against them.

IN attack by low-flying planes the characteristics which present the greatest difficulty to the solution of the problem of defense by fire are those resulting from the speed of the plane, its surprise action, and its low altitude. At 200 miles per hour the plane travels approximately 100 yards every second. As a result, a plane may come into view 500 yards away, pass down a 400-yard column and seek cover 500 yards distant in a total elapsed time of 14 seconds. It is over the head of the column in 5 seconds after it appears and has dropped its bombs upon the rear element 4 seconds later. With respect to the guns in the column which have the mission of fire against the plane, its angular travel during this total period may approximate 180 degrees.

Upon examination of the time factors and the angular speed of the plane as viewed from the ground, five facts immediately become apparent:

(1) No good purpose can be served by any attempt to scatter a column or group after the plane appears. While a scattered target may avoid casualties from fire by reason of the reduced target density, such scattering must be secured prior to the attack. Marching at greatly extended intervals or on a broad front will secure reduced density of target. Unfortunately, however, the advisability and practicability of such measures are gravely doubted though where they can be adopted they may offer advantages. It should be noted that scattering is considered to be of little value as a defense against attack by sprayed chemicals; this method of attack would probably be the answer to such dispersion.

(2) Our own planes must avoid low flight in the vicinity of our columns, for the time factor prohibits the attempt at even the simplest sort of identification and requires the assumption that a low-flying plane coming in on a column or group is hostile. Our aircraft must fly at altitudes which may not excite suspicion unless they have been informed by the ground troops that identification of planes will be made before fire upon them will be opened.

(3) It is essential to devise means of determining the approach of enemy attack and of giving warning to the column of its approach and direction. The first step in this regard is the determination of the probability of such attack and the communication of the information of probable attack to the units concerned. With reasonably good fortune the services of air observation and intelligence should be able to report the movement of hostile planes to the attack, which information should be furnished all concerned. In many cases, the direction of probable attack might probably be furnished and the hour estimated. These matters fall in the province of the higher command.

Within the small units, such as the battery or battalion, a system of observation should be provided and means of communicating information of approaching attack should be devised. Such observation should be directed with knowledge of the lines of approach favorable for hostile attack and should be sufficiently far from the column to permit ample warning of attack to reach the column. The extent of such an observation system will depend principally upon the character of the terrain—watchfulness of the crews of weapons alone may suffice in open and fairly flat country.

(4) The defensive weapons must be distributed throughout the entire column and must be capable of going into action in a matter of split-seconds. It is an important consideration to bring fire upon the plane as early as possible, for during his approaching flight he is most vulnerable since his angular speed as viewed from the weapons is low; in addition, it is very desirable to bring him down before he can drop his bombs, and before the morale of the defense is impaired by casualties or confusion resulting from the attack.

(5) The defensive fire weapons must be capable of a high rate of fire and rapid, extreme and accurate traverse in any direction; they must be capable of tracking the plane. A high rate of fire is necessary in order to put as many projectiles in the air as possible, increasing almost in proportion to their number, the chances of obtaining a vital hit. The plane should be kept under fire of all weapons throughout his entire visible flight; this requires continuous tracking at a high angular speed. Since the initial direction of fire is not known and may be toward any point of the compass the weapon must have all-round traverse and equal flexibility in any direction.

There are two types of weapons at present suited for use by the Field Artillery: the caliber .30 machine gun and the automatic rifle. Either of these has sufficient striking power to be reasonably effective against the present unarmored attack plane, and their effectiveness, if need be, can be increased by the use of the armor-piercing bullet.

The automatic rifle is the superior of the two weapons in the matter of flexibility of fire but is inferior to the machine

gun with respect to rate and volume of fire; this deficiency can be corrected, of course, by increasing the number of rifles in service.

Comparison of records of target practices shows that the automatic rifle has in the past secured a greater percentage of hits against sleeve targets than has the machine gun; however, the machine gun has not been equipped with a mount which has enabled full advantage to be taken of its capabilities. There is reason to believe that developments at present in process will produce mounts which will increase materially the percentage of hits possible with the machine gun, even beyond that at present possible with the automatic rifle.

It should be borne in mind that, other things being equal, there is a basic advantage possessed by the machine gun for our purposes, since, in defense against this type of attack, it is hits-per-second which is the true measure of efficiency.

The high efficiency of the latest types of tracer bullets makes their use a satisfactory means of machine gun fire control in fire against the low-flying plane. In this type of fire the tracer control is superior to any sight control yet developed for the machine gun. Recent tests indicate that the ratio of tracer to ball should be increased to one-to-two, since, with the increased angular speed of a 200 mile-per-hour target, the hitherto habitually employed one-to-four ratio does not provide a sufficiently high frequency of tracer in the bullet stream.

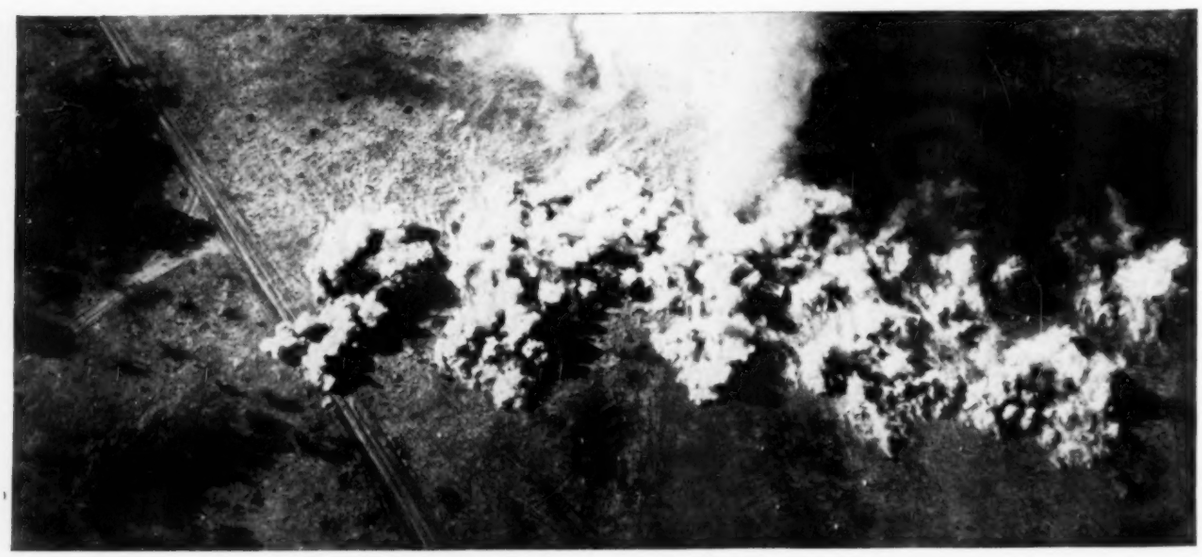
Under conditions of air attack, and especially at night, the disorganization which may result must be guarded against with the utmost forethought in training. This is particularly true of animal columns, for in these not only must the men remain exposed in order to control the animals, but the animals themselves are subject to panic. The discipline necessary to secure order under attack must be made the subject of rigorous training measures, which should include definite control duties by officers and non-commissioned officers of the column.

It seems illogical to do other than halt a column when it is attacked by low-flying planes; since: all personnel not having duties should seek what shelter is afforded by the vehicles; the personnel manning the automatic shoulder weapons must dismount and go into action and the weapons firing from vehicles should be afforded a stationary mount from which to fire; in motorized units accidents might be occasioned if a driver of a moving vehicle were to become a casualty; in animal-drawn units, even at a halt, the assistance of the cannoneers, with all drivers dismounted, will be required to control the animals.

It is the well considered belief of the writer that, in daylight, the low-flying attack of columns by machine gun fire and bombs will be attended by such a high percentage of casualties in planes that it will be found to be unprofitable and will be abandoned except as an emergency measure: this belief presupposes, of course, efficient training and proper equipment for meeting the attack. If such becomes the case, the enemy may gas us from the flank and bomb us from high altitude—either of which is less profitable to him and less dangerous to us. If we can force such action upon him, and it seems reasonably possible, we will have an answer to his greatest menace.

A successful defense against night attack is complicated by the fact that the plane may not be sufficiently visible to permit of accurate tracking by our weapons. The visibility may well be such, however, that the plane can see his target. Here indeed is a problem. Just now our hope lies in the fact that we may be able to distinguish the general dark shape of the plane, aided by the flashes from his machine guns, and in the fact that in order to drop bombs upon us he must pass over the column; this latter at least gives us a general direction of fire in the absence of being able to see him definitely. Perhaps we may come to the use of ground flares to illuminate him; possibly he will be sufficiently well illuminated at times by parachute flares dropped by preceding planes for the purpose of illuminating us; possibly we may develop an obstacle form of defense for use at night—and what a deterrent to night attack that would be! Possibly we may find it useful to imitate the squid and throw out our own smoke screen at night, into which, at low altitude, the night attack would be reluctant to plunge at his customary low altitude. Possibly we will screen our entire movements by smoke: at least the areas surrounding important defiles.

In conclusion, let us repeat for emphasis, that the first line of defense against the attack plane is in the employment of our own air forces to stop the attack at its source. Our own ground defensive means should be considered a last resort, designed for fighting off the enemy should he close with us.



**Low Altitude Attack on a Truck Convoy.**

# The Identification of Firearms

## *What the Expert Can Do in Criminal Cases and How He Does It*

By J. S. Hatcher*

IN cases of death by shooting it repeatedly happens that the life or liberty of a suspected person may depend entirely on the ability of the authorities to determine what kind of weapon did the shooting or whether a given bullet came from a given gun. Knowledge of firearms on the part of the public at large, including most peace officers and legal authorities, is so meager that almost unbelievable mistakes in testimony vitally affecting the guilt or innocence of an accused person are continually occurring.

These mistakes are so self-evident that individuals who have taken even a moderate interest in firearms frequently have enough knowledge to give a final answer to questions on which the authorities are totally in the dark. An example of this is the case of a man who was mysteriously shot with a .380 caliber automatic pistol bullet. A man who happened to be in the vicinity of the shooting was arrested because he was found to possess a caliber .380 Colt automatic pistol which had recently been fired. Things looked very serious for him until one of his friends who was interested in firearms heard of the case and began to investigate it. On examining the bullet taken from the body of the victim, this friend observed that there were seven rifling grooves on the bullet, and he happened to know enough about firearms to realize all Colt automatic pistols have six grooves and that the only .380 automatic pistol made in this country with seven grooves is the Remington. When this fact was pointed out to the authorities they released the prisoner and began looking for the owner of a Remington pistol, with the result that the real murderer was soon apprehended. There is little doubt that the first prisoner would have been convicted of a crime of which he was entirely innocent if he had not been fortunate enough to have a friend who took more than the usual interest in guns.

In another case a bullet recovered from the victim was a caliber .45 metal jacketed bullet, the type used in the government model automatic pistol. It did not take long for the police to find a suspect who had a caliber .45 automatic pistol in his possession and it probably would have gone hard with him if it had not been for the fact that a firearms expert was available who pointed out that the Colt automatic pistol has rifling with a left-hand twist, whereas the bullet in question showed right-hand rifling marks. The expert advised the authorities that the shooting was done with a Smith & Wesson Model 1917 revolver which shoots the same cartridge as the automatic pistol but which has a right-hand twist.

THESE examples, which might be multiplied by the hundred, illustrate the very great service to the cause of justice that can be rendered by even a moderate knowledge of firearms. The information rendered in these cases did not require any deep or abstruse knowledge or any special apparatus. It required only the ordinary knowledge that any alert user of firearms might possess.

There are, however, many problems occurring in connection with criminal cases in which the answer, while apparently very difficult to obtain, is really quite simple, provided there is available one of the several scientists who now make firearms identification their specialty. These men have records available of the specifications and characteristics of practically every firearm that has ever been made, and they also have elaborate and delicate instruments constructed especially for firearms identification. Moreover, they also have years of experience and study on this subject.

Without this experience, as well as access to the records and instruments referred to above, no man is fully equipped to qualify as a firearms identification expert. Unfortunately, it is only in recent years that such experts have been available, and a few years ago almost anybody with a slight smattering of small arms knowledge and a plausible manner could get up before a jury as an expert witness and either swear away the life of the accused or else throw a monkey wrench in the wheels of justice at fifty dollars a day and expenses. Fortunately the expert whose main equipment is a pocket magnifier and a footrule plus unlimited gall, is finding it increasingly harder to be permitted to qualify as an expert on this subject.

A case of this kind is described as follows by R. E. Herrick in *Arms and The Man* for May 15, 1923: "The accused secured the best legal talent that could be found, and the prosecuting attorney bestirred himself to make his case as nearly impregnable as he could humanly hope to do. To bolster his case Mr. Prosecuting Attorney employed the services of an expert (self styled) on firearms and ammunition. This man is the operative of a large, well-known detective agency.

"It was brought out in the cross-examination of this expert that he had secured a certain bullet found on the floor of the cellar, and another one from the inside lining of the coat worn by the deceased at the time of the killing. He had secured the revolver belonging to the accused and had recovered several bullets fired from this gun and by means of a magnifying glass and a so-called 'micrometer' had determined that the bullet found in the deceased man's coat had been fired from the gun admittedly belonging to the accused.

"One of his tests had been to cut off the jacket of the bullet to note the effect of the lands of the barrel on the soft lead beneath. Just what he expected to find there I cannot imagine. Perhaps he expected to find some sort of magic photograph showing the image of the fifty dollars per day he was getting for his 'expert' testimony. I suspect it was merely hocus-pocus.

"His magnifying glass used for comparing indentations on the recovered bullets, was, as I remember, either a single or double lens pocket magnifier. His micrometer caliper was nothing more or less than a Starrett inside and outside caliper rule, graduated down to 1/64-inch. And on the readings of such instruments as these, this 'expert' on firearms and ammunition was willing to swear a man's life away at the rate of fifty dollars per day.

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"I would like to hear the roar that would go up if the Ordnance Department sent out National Match Springfields accompanied by star gage records reading something like this: 19.5/64-inch, 19/64-inch, 19/64-inch, and so on."

In this case Mr. Herrick, who was president of the Boise Rifle Club, was called by the defense and I will quote further from his article as follows:

"One amusing incident occurred during cross-examination of the 'expert' by the defense. The witness was asked to show the jury the instrument used to measure these bullets. The witness passed over said caliper. The questioner took it, examined it a moment, held it up and exclaimed, 'Why this is not a micrometer, this is a monkey wrench,' much to the amusement of the spectators.

"Major Hatcher would do well to get this 'expert' on his staff at Frankford Arsenal, for see how complete is his knowledge of the manufacture of firearms:

"Question by defense attorney: 'Mr. G., have you ever spent any time in a factory where revolvers are made?'

"Answer: 'Yes, sir. I have been through Browning Bros. plant.'

"Question: 'Explain to the jury how revolver barrels are made.'

"Answer: 'They are cast in moulds.'

"Shades of Samuel Colt and of Eliphalet Remington! Such 'expert' testimony in a trial wherein twelve good men and true are to decide whether a fellow-man is not guilty of the crime of murder. If that sort of testimony is worth fifty dollars per day then a hodcarrier who knows his business should receive remuneration at a rate of not less than $5,000 per day."

This case is merely one of a number of similar or even more flagrant ones that have come to my attention. In one case in New England a man was actually convicted and sentenced to death but afterward given a new trial and acquitted when a member of a revolver club became interested in the case and developed the fact that in spite of magnifying glass and micrometer, the "expert" in this case had failed to notice that the bullet had six grooves whereas the defendant's gun had only five.

THE present science of firearms identification as it exists in this country may be said to have its origin in the notoriety aroused by a gross miscarriage of justice in New York State. One C. E. Waite, formerly an operative in the Department of Justice, became interested in this case and started work along this line which since his death (November, 1926) has been ably carried on by Lieut. Col. Calvin Goddard, Ord. Res., and others.

At daybreak on March 22, 1915, Charlie Stielow, an illiterate, good-natured tenant farmer, when going out of his house discovered a woman in her nightdress lying dead on his doorstep, shot through the heart. Her footsteps in the light fall of snow led from the nearby house of Charles B. Phelps, the owner of the farm.

The dead woman, Miss Wolcott, was housekeeper for the aged Phelps who was reputed to keep large sums of money in the house. Stielow found the kitchen door of the Phelps house open, a bullet hole in the glass and his employer, a man of seventy, unconscious on the kitchen floor with three bullet wounds in his body. A lighted lamp was burning low on a nearby table. Stielow at once ran to a neighbor's house and gave the alarm. It was quite evident that robbery was the motive, as the bureau where Mr. Phelps kept his money was rifled and his wallet was missing.

The murder was committed in a small rural community, and the local authorities, unused to coping with such crimes as homicide had allowed the curious crowd to trample the foot prints and destroy most of the clues before any real constructive work was done toward solving the mystery. Stielow lived in the tenant house with his wife and two children, his wife's mother and his wife's brother, Nelson Green. The shooting had been done with a caliber .22 firearm and both Stielow and Green swore at the inquest that neither had a gun of any kind, but it turned out later that Stielow owned a cheap caliber .22 revolver and a caliber .22 rifle and that he had given these guns to a younger brother-in-law to hide.

After ten days had elapsed without any progress, Nelson Green was arrested and at two o'clock the next morning detectives secured his signature to his confession that Stielow and he had committed the murders. Stielow was thereupon arrested and held in jail separately from Green. He made a request to be allowed to talk to his wife as he said he had a heavy burden on his soul. He was, therefore, accused of the crime and as is not unusual in such cases, he also finally confessed.

The two confessions checked generally though neither told anything that was not common knowledge to everybody who had been in the vicinity, except that each man accused the other of instigating the crime and firing the fatal shots. The confessions stated that they had planned to rob Phelps and had waited outside until he was in bed, then rapped on the kitchen door and shot him down when he answered the knock. As they went toward the bedroom where they expected to find the money, the housekeeper ran out of her room through the kitchen and out of the door, closing it behind her. The two men ran after her, shot at her through the glass, ran to the bedroom, made a search until they found the money, and leaving the house, heard and saw the housekeeper pounding and clawing at the front door of the tenant house and screaming to be admitted. Ignoring her, they entered the rear door of the house, discussed the screams with the women folks, and then went to bed. They said they got about two hundred dollars and each man accused the other of having kept it.

At the trial the farmer repudiated this confession and when questioned about the "heavy burden" he had spoken of, said it was the fact that he had lied about not having any guns. An "expert" for the prosecution testified that under the microscope he had found nine abnormal defects in the flare of the muzzle of Stielow's gun, and found nine corresponding peculiar scratches on the four bullets taken from the bodies. The scratches were not visible to the naked eye, he said, and were first detected under the lens, and he gave it as his opinion that all the bullets were fired from Stielow's gun and could have been fired from no other.

On cross-examination it was brought out that the enlarged photograph of the bullets showed to the jury by the "expert" did not reproduce the nine marks; it was, for some unknown reason, a photograph of the opposite side of the bullet. Asked why the uneven ridges at the very extremity of the barrel should mark the bullet, the "expert" replied: "The cylinder fitted so tightly against the rear of the barrel that there was no leakage of gas at the breech. The full force of the gas following the bullet out at the muzzle, the lead expands as it leaves the muzzle, fills in any depressions existing at the outer

edge of the bore and receives scratches from the elevations existing between said depressions."

On the basis of the "expert" testimony that the bullets had been fired from Stielow's revolver and could have been fired from no other, the jury found Stielow guilty of murder in the first degree and sentenced him to die in the electric chair sometime during the week of September 5, 1915. Green was told that Stielow had been sentenced to death and that if he would confess he might get off with twenty years. Accordingly he plead guilty and was sent to Auburn Penitentiary.

BUT Stielow did not go to the electric chair. His lawyer was convinced of his innocence and began a series of appeals, and a Humanitarian Cult of New York City began taking an interest in the case. Members of this cult soon found some slight evidence that two tramps and horse traders who had been in the vicinity of the house might know something of the murders. While this investigation was going on, the case had been reviewed by the Court of Appeals and a motion for a new trial was denied in February, 1916. In June of that year a second application for a new trial and in July a third were denied, and in October a fourth appeal met the same fate. All the judges found that Stielow had been fairly and justly convicted. In the meantime the Humanitarian Cult had been strengthening the evidence against the two-horse peddlers and finally on December 4, 1916, the Governor, unsatisfied of Stielow's guilt, commuted his sentence to life imprisonment.

During this time the ignorant farmer had been adjudged guilty by a jury and by ten judges who had subsequently passed on his case in connection with the numerous appeals. Finally the Governor had one of the two suspected horse traders brought before him and his answers were so evasive and unsatisfactory that the Governor appointed a prominent Syracuse lawyer, Mr. George H. Bond, to conduct a special investigation into the case of the murder of Phelps and his housekeeper. Mr. Bond drafted Mr. Waite from the Attorney General's office to aid him.

Under searching analysis, the confessions of Green and Stielow, once considered solid evidence, appeared in a new light. Such glaring inconsistencies were discovered as to make it almost self-evident that the men who made the confessions could not have had first-hand knowledge of the crime.

After shooting down Phelps, as told in the confession, Stielow was supposed to have picked up the lamp and advanced from the kitchen through the dining room and a small hall and was just about to enter the aged man's room to search it, when Miss Wolcott, the housekeeper, ran out of her room, through the dining room toward the kitchen door. By the time they reached the kitchen she was outside and the door was closed behind her. They shot her through the glass door and heard a scream. If the confession is to be credited, the two men fired at the fleeing woman, and did not even bother to see whether or not she was hit, but allowed her to run screaming into the night to arouse the neighborhood, while they returned to ransack the premises and make a careful search for the money.

Miss Wolcott, when she ran through the kitchen, passed close to Stielow who was carrying a lighted lamp and wore no disguise. His mere bulk would have identified him, and it is incredible that she would have failed to recognize this man who had been working on the farm under her direct observation. Yet to credit the confession, we must believe that the housekeeper fled directly to the home of her slayer for sanctuary, crying out to him by name to open the door, knowing as she must have that he was not there but in the house from which she had just run. At the least calculation, it would have taken an expert cracksman ten minutes to make the search of the bedroom as detailed in the confession. Yet when Stielow and Green emerged from the house after finding the money, Stielow is supposed to have heard Miss Wolcott crying, "Charlie, please let me in, I am dying," and beating on the door of the tenant house.

Miss Wolcott had been shot directly through the heart with a jagged and deformed bullet which had been battered out of shape by first passing through a pane of glass. Yet this woman of fifty is supposed to have run a hundred yards after she was shot, and at least ten minutes later to have been screaming loudly enough to be heard in the next house. Apparently no one had even taken the trouble to measure the distance from the floor to the hole in the glass of the kitchen door and check it against the statements of the defendants. The confessions stated that Miss Wolcott was outside, with the door closed behind her when she was shot. Outside the door, which opened inward, there were several steps leading down to the ground. The threshold was less than two inches wide. No one could stand on the threshold while the door was closed.

The hole in the glass was exactly three feet, eight and one-half inches from the floor, and showed plainly by its shape that the bullet had gone through on a line, and not on an angle. The course of the bullet through the body also indicated that the shot had been fired on a nearly horizontal line. Miss Wolcott was half an inch less than five feet tall. Once she was outside and the door closed, a bullet could not hit her below the shoulder. The height of the wound in her body was exactly that of the distance from the kitchen floor to the hole in the glass. The conclusion was irresistible that she was shot while the door was partly open and she was on the level of the kitchen floor, or at the moment of leaving it and turning to leap from the steps, and that whoever fired the shot was not pursuing her as Stielow's confession stated, but was standing over the body of Phelps behind the partly opened kitchen door.

FIRING tests were made with Stielow's revolver in the presence of Captain Jones, the revolver expert of the New York Detective Bureau, Dr. Otto Schultz, Police Surgeon, Inspector Faurot, Bond, Waite, and others. Before firing, the revolver was handed to Captain Jones and his opinion asked as to how long a time had elapsed since it had been fired. "Certainly three or four years, apparently a longer time," Jones said after he had examined the heavy incrustations in the barrel, discolored with age. According to Stielow, the gun had not been used for seven years.

The first test was made by placing a sheet of paper over the gun and firing a cartridge of the same type as those found in a box in Stielow's possession. Instead of there being no leakage of gas at the breech end of the barrel, as the "expert" had testified, the paper was set on fire. Afterward bullets were fired into cotton and recovered and the test bullets were then taken to an optical plant at Rochester for scientific examination by Max Poser, an expert in microscopic research. Neither Poser nor anyone else could find a trace of the peculiar scratches which had doomed Stielow, either under high- or low-powered lenses, but even more amazing

was the fact that one of the lands on the murder bullet was abnormal, equalling the combined widths of two normal lands in one groove, while there were five lands and five grooves all of normal width on the test bullets from Stielow's gun. The killing of Phelps and his housekeeper undoubtedly had been done with a defective gun in which the rifling tool had presumably been broken, or the rifler had failed to complete his operation and the error had escaped the inspector's notice. The distinction between the two sets of bullets was glaring, and there was no possible chance that the fatal bullet could have come from Stielow's gun.

The micrometer completed the evidence. When the bore diameter of the Stielow gun barrel and that of the murder bullets were compared, the bullets were found to be .0018 of an inch smaller. These were not opinions; they were facts.

Bond and Waite had no further doubt that Stielow was innocent, and the Governor accordingly pardoned him. The two horse traders were brought to trial and made a full confession, telling many facts which had not been known before but which were easily checked up and found to be true.

This case got Waite to thinking that if enough data on arms and ammunition could be collected, some method might be evolved whereby it would be possible to determine at least the make of arm, and perhaps even the particular individual gun figuring in a given case. He accordingly visited factories in this country and abroad and collected a mass of data on guns of all kinds.

ONE of the first things necessary was to know the bore diameters, kind of lands and grooves, pitch of rifling, and in short, all the various mechanical characteristics of every make of firearm. Much of this information was well known or easily available, especially that relating to the more common guns now under manufacture and on sale. For example, almost everyone who is at all interested in guns knows that all American made pistols or revolvers have a right-hand twist except those made by the Colt's Patent Fire Arms Manufacturing Company who use a left-hand pitch; and that Colt uses six lands and grooves while Smith & Wesson use five in most of their models; also that Colt has wide grooves and narrow lands while in the Smith & Wesson both lands and grooves are equal in width. The following tabulation may be useful:

*Smith & Wesson:* The first model caliber .22 Smith & Wesson, with the barrel that tipped up to load, had 3 grooves, left-hand. However, all modern Smith & Wesson's have a right-hand twist with lands and grooves equal in width, and 5 grooves in all except the caliber .22, the .32 and .35 automatics, and the .45 Model 1917, which have 6.

*Pitch of rifling as follows:* .45 Schofield, 1 turn in 24 inches; .45 Colt, 1 in 20; .45, M1917, 1 in 14.659; caliber .44, 1 in 20; .38 Winchester (.38/40), 1 in 20; other .38 calibers, 1 in 18¾; caliber .32, except .32 Winchester, 1 in 18¾; .32 Winchester (.32/20) and .32 and .35 automatics, 1 in 12; caliber .22, 1 in 10. Depth of grooves from .003 to .006 according to caliber and model.

*Colt:* Some of the early percussion models had seven grooves, right-hand twist. Many of the early metallic cartridge models, in both rim and center fire, had 7 grooves, left-hand twist. However, all modern Colt revolvers and automatic pistols have a left-hand twist with 6 grooves. The grooves are approximately twice the width of the lands; the bore somewhat smaller than the Smith & Wesson to compensate for wider grooves. Groove depth, .0035-inch. The pitch 1 turn in 16 inches in all models except the .22 which is 1 turn in 14 inches.

*Iver Johnson:* Some earlier models had 3 grooves, right-hand twist. However, all the latest ones have 5 grooves .005-inch deep, and resemble the Smith & Wesson in general appearance. In some cases the land and groove are equal, while in other cases the land may be considerably wider than the groove. In the caliber .22 the pitch is 1 turn in 15¾ inches; in the others it is 1 turn in 23½ inches.

*Harrington & Richardson:* Right-hand twist, with pitch 1 turn in 12 inches. Now has 6 grooves in all models approximately .005-inch deep. Formerly the .32 and .38 revolvers and some of the .45 automatic pistols had 5 grooves.

*Savage Automatic Pistol:* Six grooves .003-inch deep, right-hand twist, 1 turn in 12 inches for the .32 and .380 automatic pistols, and 1 turn in 16 inches for the .45 pistol of which a few were made for the Army.

*Remington Automatic Pistol:* Seven grooves, right-hand twist, .0035-inch deep, 1 turn in 16 inches.

WHILE it was quite easy to get together certain data on the more commonly used guns, such as that given above, it was necessary to have more than this. Very frequently it happened that the weapon involved might be either of foreign make or some old model which had long ago been discontinued. It became necessary, therefore, to collect data on not only the more common guns but on all the foreign guns, and, as far as possible, on all the old, obsolete models.

Collecting this information, especially on the older models, required years of work, for in many instances factories had no records of their older models and in trying to find out about them, Mr. Waite consulted retired foremen who in many cases furnished information from their private notebooks and other unofficial records.

However, when all the data on American guns, even the obsolete models, had been located the work had still only fairly well begun as the country was flooded with cheap foreign pistols just after the World War and in many cases the trade marks or names of these guns meant little or nothing because frequently these cheap revolvers or automatic pistols were turned out by the thousands by little jobbing shops and individual contractors, and almost any trade mark imaginable might be used. One exporter with a certain trade mark might buy from one jobber at one time and from another at another time. However, it was found that there were certain more or less general patterns in use even by these small jobbing shops, and Waite determined to do whatever was possible to collect a codification of the miscellaneous information along these lines. Accordingly he started out to collect data from foreign countries, and armed with authority from the State Department and accompanied by an Army officer as interpreter, he patiently waded through all the large factories and through dozens of small factories and gun shops, collecting their trade marks, their rifling standards, their various models, and in short, every characteristic of every gun in the world so far as it was possible. The result was the assembling of what is undoubtedly the most complete set of data of this kind in the world.

On his return to New York, Waite enlisted the services of Colonel Goddard, internationally known firearms expert; Philip Gravelle, an expert photographer; and John H. Fisher, an authority on precision measurements. These men estab-

lished the Bureau of Forensic Ballistics in New York City. On the death of Waite in November, 1926, this Bureau was continued by Colonel Goddard until June, 1930, when the records and instruments were taken by him to the Scientific Crime Detection Laboratory of Northwestern University, at Chicago, which is now the leading authority in the world on firearms identification. Captain Edward C. Crossman, of Los Angeles, formerly on Colonel Goddard's consulting staff, now handles work of this nature on the West Coast. New York City now teaches firearms identification in the Police College of the State of New York under the able instruction of Stanley F. Gorman. Among other experts on this subject should be mentioned: Dr. Wilmer Souder, of the Bureau of Standards, Washington, D. C.; Capt. Charles J. Van Ambergh, of Boston; E. O. Heinrich, of Berkeley, California; Mr. John A. French, of the Pennsylvania State Police; Mr. Thomas Lewis, of the St. Louis Police Department; Prof. J. H. Mathers, of the University of Wisconsin; Lieut. Col. Charles O. Gunther, Ord. Res., of Hoboken; Capt. Seth Wiard, Ord. Res., of Chicago; and Detective Lieutenant John H. Fowler, of the Metropolitan Police, of Washington, D. C.

Even though a crime detection laboratory has a vast amount of detail information and specifications as indicated above, it is still not fully equipped to handle firearms cases. In addition, certain instruments are needed; also samples of all guns and cartridges which they will fire, and as far as possible, a sample fired bullet from each type of gun. Last but not least, the personnel must have a certain background or general knowledge concerning firearms and how they operate.

IN summarizing the elementary general knowledge that should be available, it may be well to review the fact that firearms are of two main classes. First, guns which leave no identifying rifling marks on the bullet, such as shotguns or the old smooth-bore muzzle-loading muskets. Second, the rifled fireams; these guns have spiral grooves in the barrel so that a bullet passing through will be caused to rotate and thus remain point-on and retain its direction of flight. Rifled arms leave marks of the rifling on the bullet. The rifling consists of grooves in the bore and of raised spaces between the grooves which are called lands. When a bullet is fired in a rifled arm, it fills the grooves of the rifling and the fired bullet has ridges on it corresponding to the grooves in the gun and depressions or grooves corresponding to the lands in the gun.

Rifling grooves may vary in number from two up to a dozen or more. However, in modern revolvers there are usually either five, six or seven grooves. The rifling may be arranged to spin the bullet to the right or in a clock-wise direction, in which case it is called right-hand rifling, or in the opposite or contra-clockwise direction, in which case it is called left-hand rifling.

Guns are of different sizes depending on the diameter of the bore, which is described in hundredths of an inch and called caliber. Thus a caliber .30 gun is one in which the bore of the gun has a diameter of thirty one-hundredths of an inch. After the hole of this diameter has been bored through the barrel, the rifling is put in so that the diameter across the rifling grooves is larger than the caliber. Thus a caliber .30 rifle has grooves which are .004-inch deep so that the diameter across the rifling is .308-inch. The caliber of foreign guns is usually given in millimeters, as for example, a caliber .30 gun made in Europe would be called caliber 7.63-mm.

The mere fact, however, that a gun is called a certain caliber does not guarantee that the diameter across the lands will be that many thousandths of an inch, as there have been many changes in the general principles of gun construction in recent years and some of these changes have resulted in changing the diameter of the gun without changing the name of the caliber. Thus, the .38 Special Revolver of Colt make has a bore which is only .346 and grooves which are .353 in diameter. The bullet for this gun is made .359 so that "caliber .36" would be closer than .38 as a descriptive name for this gun. On the other hand, another caliber .38 revolver, the .38-40, has a groove diameter of .401 so that this should really be called caliber .40.

Shotguns are usually named in another way, that is, by "gage." Thus we have 10-gage, 12-gage, 16-gage and 20-gage shotguns. "Gage" means the number of round lead balls fitting that gun that it takes to make a pound, thus a shotgun which is the right size to shoot a one-ounce round ball is a 16-gage gun because it takes 16 of the balls to make a pound. However, some shotguns are named by caliber, as for example the one that is called the .410 gage shotgun. In this case .410 gage actually means .41 caliber.

BESIDES the different types of guns described above, there are several distinct types of cartridges or methods of loading. In the first place the old guns years ago had no cartridge. The powder was put in the gun, and on top of it a wad, then the bullet, and the powder was ignited by a flint lock or by a percussion cap.

The first type of metallic cartridge to become popular was what is known as the pin-fire type. Cartridges of this kind have a primer or cap inside and a little pin like a short nail sticking out of the side. There is a slot in the breech of the gun barrel or revolver cylinder for this pin to stick through, and in firing the gun, the hammer drives the pin downward into the cartridge, discharging the cap. Pin-fire cartridges are still used in many foreign guns but are comparatively rare in America.

Most of our modern larger caliber revolver cartridges are what are known as center-fire. This means that there is a cap or primer in the center of the cartridge head. These center-fire cartridges may be further divided into two types, rim cartridges, which have a flange or rim around the head for seating the cartridge in the barrel or cylinder and for affording a hold for extraction; and rimless cartridges which instead of having a raised flange around the base, have a groove cut around the base for the extractor hook.

As the head of a rim cartridge serves not only for extraction but also for seating the cartridge in the chamber, some provision to accomplish this must be made in the rimless cartridges, otherwise they would go all the way into the barrel and would not be supported against the firing pin blow. In the .45 automatic pistol cartridge, which is rimless, the seating is on the front edge of the cartridge case which butts against a little shoulder formed in the chamber of the gun.

In the .38 automatic pistol cartridge there is no square front edge of the cartridge case as the case is crimped into a groove in the bullet. In this cartridge the rim is made just a little bit bigger than the diameter of the case so that there is really a slight bearing of the rim against the back end of the chamber. This is not strictly a rimless cartridge but what is more properly called a semirim. Rimless pistol cartridges are designed primarily for use in automatics but there are also

some revolvers such as the Colt and Smith & Wesson Model 1917 revolvers which use the .45 automatic pistol cartridge.

There is still another kind of cartridge of a type known as rim-fire, which is the one commonly used for caliber .22 (though there are a few .22's made in center-fire). Most cartridges larger than .22 are made in center-fire except some old time guns of calibers .32 and .38 use rim-fire cartridges, and the Remington Double Deringer, which is still manufactured, uses a caliber .41 rim-fire cartridge.

The rim-fire differs from the center-fire in that the rim of the shell is made of thin copper folded over so as to leave a hollow space inside and this space is filled with priming composition. The hammer or firing pin strikes this hollow rim and pinches it against the breech of the gun or cylinder, thus igniting the priming composition.

THE ordinary caliber .22 bullet and most of the revolver bullets are made of lead without any other covering except in some cases a thin plating of copper or some metal like cadmium. Lead bullets are fairly soft and easily deformed and lend themselves very well to taking a good impression of the lands and grooves as they pass through the bore when the gun is fired. The copper-plated bullets, Lubaloy-plated bullets and cadmium-plated bullets all have such a thin coating of metal plating on them that it does not noticeably change their characteristics in this respect.

As opposed to the lead bullets described above, which are commonly used in revolvers, there is a metal-jacketed type which is commonly used in automatic pistols. In this type there is a case or bullet jacket formed out of cupro-nickel, gilding metal, or soft steel. The lead core, or main part of the bullet, is placed inside this hard envelope and swedged before being finally shaped in a heavy press which turns the edges of the jacket or envelope over at the base so as to hold the lead core firmly in position. Practically all modern high-powered rifle bullets such as our caliber .30 Army bullet are made in this way with a strong jacket. Naturally while this jacket is soft enough so that the lands of the rifle can cut into it and thereby spin the bullet, it is not as soft as lead, therefore these jacketed bullets do not take as nice an impression of all the irregularities of the barrel as does the lead bullet.

There is a third kind of bullet known as the soft-point bullet. In this the metal jacket covers the base of the bullet and the cylindrical part, but leaves the lead point exposed so that it can expand or mushroom on striking.

It should be noted here that jacketed bullets made in America are always covered with either cupro-nickel, or with gilding metal, which is a composition consisting of 90 parts copper and 10 parts zinc. There is no such thing as a steel-jacketed bullet made in America. On the other hand, steel either heavily coated with cupro-nickel or not coated at all is the favorite jacket material for European-made ammunition.

This fact in itself may sometimes be of use in clarifying circumstances surrounding a crime and pointing investigators in the right direction. Two men who might possibly have been involved in a shooting affair in which the victim was killed with a small caliber .32 bullet were each found to have in his possession a partly used box of caliber .32 cartridges. The cartridges belonging to "A" were of domestic make while those belonging to "B" were imported. The investigator applied a magnet to the fatal bullet and found that it was attracted to the magnet thereby proving that it had a steel jacket, indicating the probable innocence of the suspect "A."

THE experienced investigator will always be on the lookout for certain unusual circumstances that might mislead the tyro. When a pistol bullet is found at the scene of a crime it is not always absolutely certain that a pistol was used. There are adapteres shaped like a cartridge which fit into the chamber of a high-powered rifle and enable a pistol cartridge to be fired in the rifle. The caliber .32 automatic pistol cartridge and the caliber .32 Smith & Wesson revolver cartridge are favorites for this use.

During the World War the United States had an automatic bolt for the Springfield rifle that could be inserted in the rifle in place of the regular bolt, which enabled a special small caliber .30 pistol-type cartridge to be fired automatically in this rifle. This automatic bolt, called the Pedersen Device (Army Ordnance, Vol. XII, No. 72, page 384), had a short barrel which just filled the chamber of the rifle. This little auxiliary barrel had ten fine lands and grooves which started the bullet spinning before it struck the four-grooved barrel of the rifle. As the little auxiliary barrel just screwed into the holder and did not have any fixed relation to the rifling in the barrel, its lands and grooves might come anywhere in relation to the main rifling grooves. Thus a bullet fired from it would probably have very queer markings on it and as this device was kept entirely secret it would have offered quite a puzzle for the firearms expert.

Then, as mentioned above, the mere fact that a .45 automatic pistol bullet is found does not prove that the Army automatic was used, as this bullet is also used in the Colt Model 1917 revolver, the Smith & Wesson Model 1917 revolver, and the Thompson sub-machine gun.

An inexperienced person on finding a jacketed bullet of caliber .32 at the scene of a crime is likely to assume that an automatic pistol must certainly have been used, and on finding a lead bullet he will consider that it was fired from a revolver. The chances are that these assumptions are correct, but this is not always true as it is quite possible to get automatic pistol cartridges loaded with lead bullets, and on the other hand, jacketed bullets may be used in a revolver. Then there are several cartridges, particularly some of the old time ones, which were popular in frontier days, that were used in either the rifle or revolver. These are the .32-20, the .38-40 and the .44-40. As everyone knows, the .22 short, long and long rifle cartridges are used in revolvers, automatic pistols and rifles.

Besides the data and information described above, there are certain instruments which are indispensable. These will be named and described briefly and a more detailed account of their use will be given in describing the method of working on different problems which arise.

The most elementary investigation of a crime involving firearms requires a knowledge of the size and weight of the bullet, hence it is necessary to have scales and measuring instruments. The scales should be of a type capable of determining weights within a limit of one grain. Measuring instruments should include graduated steel scales for rough measurements and micrometers for more accurate measurements. In addition, it is almost indispensable to have a type of micrometer known as the dial gage which measures readings recorded by a spring plunger on a dial to ten-thousandths of an inch. These dial gages are commonly used by tool makers and are relatively inexpensive but are accurate and convenient for such measurements as the depth of grooves in a bullet. (*To be concluded in the next issue.*)

# Mobilizing the Conservation Corps

## *The Army Does a Gigantic Job in Record Time*

By Col. Duncan K. Major, Jr.*

ON May 12, 1933, the President approved the War Department plan to place the full authorized quota for the Civilian Conservation Corps (274,375 men) in work camps by July 1. That mission fulfilling President Roosevelt's promise to the country to have 250,000 men employed in the nation's forests by early summer has been accomplished by the Army on time.

On April 6, 1917, the United States declared war on Germany and initiated the mobilization of the country's manpower. On Monday, April 3, 1933, practically the same date, Mr. Howe, Secretary to the President, speaking in the White House to the War Department's General Staff representative, said "The President wants to start the enrollment of 25,000 men on Thursday (April 6). Can the Army do it?" The answer was, "Yes, sir, the Army can." Orders were issued on that basis. The "new deal" was on. During the first three months of the World War, the War Department mobilized by July 1, 1917, 117,000 men in the Regular Army, 58,000 men in the National Guard and 6,000 men in the National Army, or a total of 181,000 men. By that date less than 16,000 men (mostly Regular Army units) had embarked for France. How then during a like period in 1933, without a long warning such as was given by the European War could the Regular Army alone process some 275,000 men, organize them into 1,330 companies, establish that many forest camps on a front of 3,000 miles from the Atlantic to the Pacific, distributed in depth from Canada to Mexico, occupying every state of the Union, excepting only Delaware, and move 55,000 of them a distance of 2,200 miles from the east coast to the Rockies and the Sierras, all before July 1 of this year? The comparison is so vivid, the contrast in the two efforts so striking, that a short history of the War Department's part in the mobilization of the Civilian Conservation Corps may be worth recording.

The introduction in the U. S. Senate of Senator Couzens' bill, submitted on January 10, 1933, providing that the Army shelter and feed indigent transient youths, which later took more definite form in an amendment to the Army Appropriation Bill offered by him in early February to care for 88,000 boys under Army control, served as a warning to the War Department of the task since imposed. While the Couzens' bill was under consideration, a General Staff study was made to determine the Army's capacity to care for the men on its posts, and the unit costs per man to govern as a basis of estimates. The data were available in time to give real definition to the amendment proposed by Mr. Couzens in the Appropriation Bill.

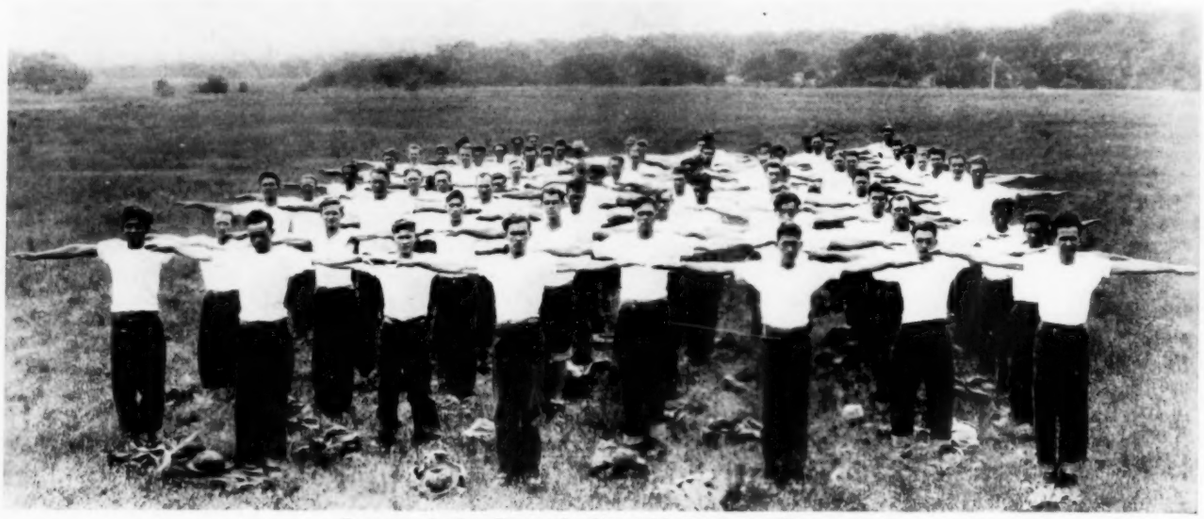
IT was early evident after Mr. Roosevelt's inauguration that the President would lose little time in launching his plan for reforestation. With definite conviction that no matter how earnestly organized labor, the Department of Labor, the United States Forest Service might advise against the use of the Army in the fulfillment of the program in order to avoid criticism as to the regimentation of labor, the military influence of the Army and the like, there was but one path open to its rapid accomplishment, whether or not it met with the War Department's plans or interfered with its missions, the Chief of Staff on March 9 directed estimates and regulations to be prepared for the reception, organization and care of units of unemployed men. This was long before the undertaking was defined. The original administration bill was introduced on March 13, 1933, and after much criticism, reintroduced in more general terms on March 21. By March 24, however, the General Staff had prepared in draft form complete regulations governing the administration and supply of the Civilian Conservation Corps ready for issue to the field, defining the Army's mission, its relations with the Department of Labor, the National Park Service, and the United States Forest Service, setting up probable quotas of men to be assigned the various Corps Areas and the probable unit costs covering the items of shelter, subsistence, clothing, equipment, medical attention, rail and motor transportation, welfare and supervision. On March 25, all nine Corps Area commanders received secret radios warning them of the task that would probably fall to them, the tentative quotas of men that the War Department believed would be assigned to their Corps Areas and promising early allotment of funds on the basis of the unit estimates.

The bill as finally passed left most of the details to the discretion of the President. The relations that would govern between the various executive departments were not stated. The General Staff, therefore, on the 24th of March drafted an executive order establishing these relationships and announcing basic decisions controlling the coöperative effort.

During this period before final passage and approval of the Act on March 31, 1933, both the regulations and the proposed executive order were modified to coördinate them with the plans of the Labor Department and the United States Forest Service. The essential thing to record is that by proper planning the General Staff stood ready on March 24 to go, awaiting only the starter's gun. It was expected, of course, that actual passage of the act would bring last minute modifications, that coördination with other departments and agencies would require further clarification but the elemental provisions to receive, to feed, to transport, to house, to examine physically, to clothe, to organize large numbers of men, let the exact pattern of the organization or its future employment be what it might, were cared for. These were the features that plainly indicated to the War Department that the Army would get the job.

THE Director of Emergency Conservation Work appeared on the scene for the first time on the evening of April 3rd. Mr. Persons, representative of the United States Department of Labor, who since has performed so excellent a service in the selection of members of the Civilian Conservation Corps, arrived in Washington that day and that evening made his first recommendations as to policies to govern selection. Approval by the Director of the War Department's regulations

*War Department Representative on the Advisory Council, Emergency Conservation Work. Colonel, General Staff, U. S. Army.



**Conservationists Begin the Day with Setting-up Exercises**

was essential and agreement by Mr. Persons to the coöperation to obtain between the two departments in the matters of selection and enrollment was necessary. Last minute changes were made in the War Department regulations. The proposed executive order was never issued. However, the President's approval of the regulations on April 5th covered part of the ground in fixing the missions of the various government agencies coöperating in the effort. On April 5th the War Department issued radios to all Corps Area Commanders assigning their missions and directing them to enroll the first increment on the following morning. The next day the complete regulations were forwarded to them. The Army was in gear to fulfill its part of the task.

While Corps Area Commanders contacted the local representatives of the Labor Department and indicated their readiness to accept men and their arrangements to do so, insufficient time for the selection delayed the local agents. The first men to be accepted for enrollment by the Army were received from the Labor Department on April 7.

Now at this time when the first increment of 25,000 men came marching in the Army's mission was definitely limited and was to terminate at the earliest practicable moment. After receiving the men, enrolling them, initiating their records, organizing them into units, clothing and equipping them, the Army was to transport the unit to the railheads near the forest project and there turn them over completely for future administration and care to the United States Forest Service or other federal agency employing them. In all prior interdepartmental conferences no more had been asked of the Army. The earliest possible termination of the Army's contact with the effort had been sought. While this was in complete accord with the Army's hopes and purposes, interfering to a minimum with its missions under the National Defense Act, no such expectation was contemplated as probable. A Staff officer with experience during the World War with the Spruce Production Division in the Northwest where a similar problem of Army control and work in the field under civilian supervision had been presented was at work on regulations to control the effort of the Army and to define the relationships between departments when and if the tasks of the Army were extended to the administration, supply and care of these men throughout their service.

True to that estimate, the War Department General Staff representative was called to the White House on the night of April 8th. Mr. Howe proposed that the Army continue to exercise control over all matters except technical supervision of the work itself. The General Staff officer presented every argument opposed to such an increase in the Army's functions, the statements and claims of the United States Forest Service that they desired complete control over the men and were able to exercise it. The answer was, "You have given all the reasons in the world why the Army should do this job. As a matter of fact, all the reasons you state show that nobody else can do it." Decision, however, was reserved until the Secretary of War could see the President on Monday, the 10th. The Army got the job that Monday.

Again General Staff planning and preparation met the situation. The ground work had been laid. Work without regard to hours that week-end produced a set of regulations ready for issue that Monday morning and estimates of costs on which to requisition the necessary funds. These, however, had to be approved by the Director, Emergency Conservation Work. They were discussed at numerous conferences with the representatives of the United States Forest Service, National Park Service, Labor Department, Office of the Chief Coördinator, all present. Matters in controversy were referred to the White House for decision. Despite delays, warning radios were dispatched to the nine Corps Area Commanders on the 12th and detailed regulations were forwarded on the 19th. These regulations of April 5 and April 19 have, with but minor changes, governed the War Department's administration, supply and care of the Civilian Conservation Corps ever since.

IN Washington the period from April 6 to May 10 was one of delay and confusion. On May 10, a total of but 52,000 men were enrolled, an average of 1,630 men per day; 42 work camps had been established. Projects had been generously approved in the Rockies and Sierras, but few were available to employ the men in the East and Central West. On May 1, out of a total enrollment of 38,500 men, there were 18,700 men for whom there was no forest work within their own states, or those nearby. Unless work camps were developed in the great region east of the Rockies, it was evident that either a vast movement of men would be necessary across the continent or the Civilian Conservation Corps would find its

**Young Men of the Civilian Conservation Corps Ready for an Army Meal.**

ceiling at about 100,000 men. Authority was not decentralized. Money was allotted for short periods only. Restrictions were placed on purchases of new supplies and equipment. Thus, on May 3, a chart in the General Staff forecasting the effort under the conditions then prevailing bore curves showing a probable total of 115,000 men by July 1 and a probable occupation of 375 camps on that date. A result far short of the President's announced intention of having 250,000 men in the forests by early summer was clearly indicated. The truth of this became increasingly evident among the members of the Director's Council during the next week. On May 10th, the Director, addressing the War Department's representative by letter, expressed his disappointment at such a prospect and asked the War Department to present on May 12 its plan and requirements to meet the President's objectives of enrolling the full quota of 274,375 men and placing all Civilian Conservation Corps organizations organized therefrom in camps by July 1, 1933.

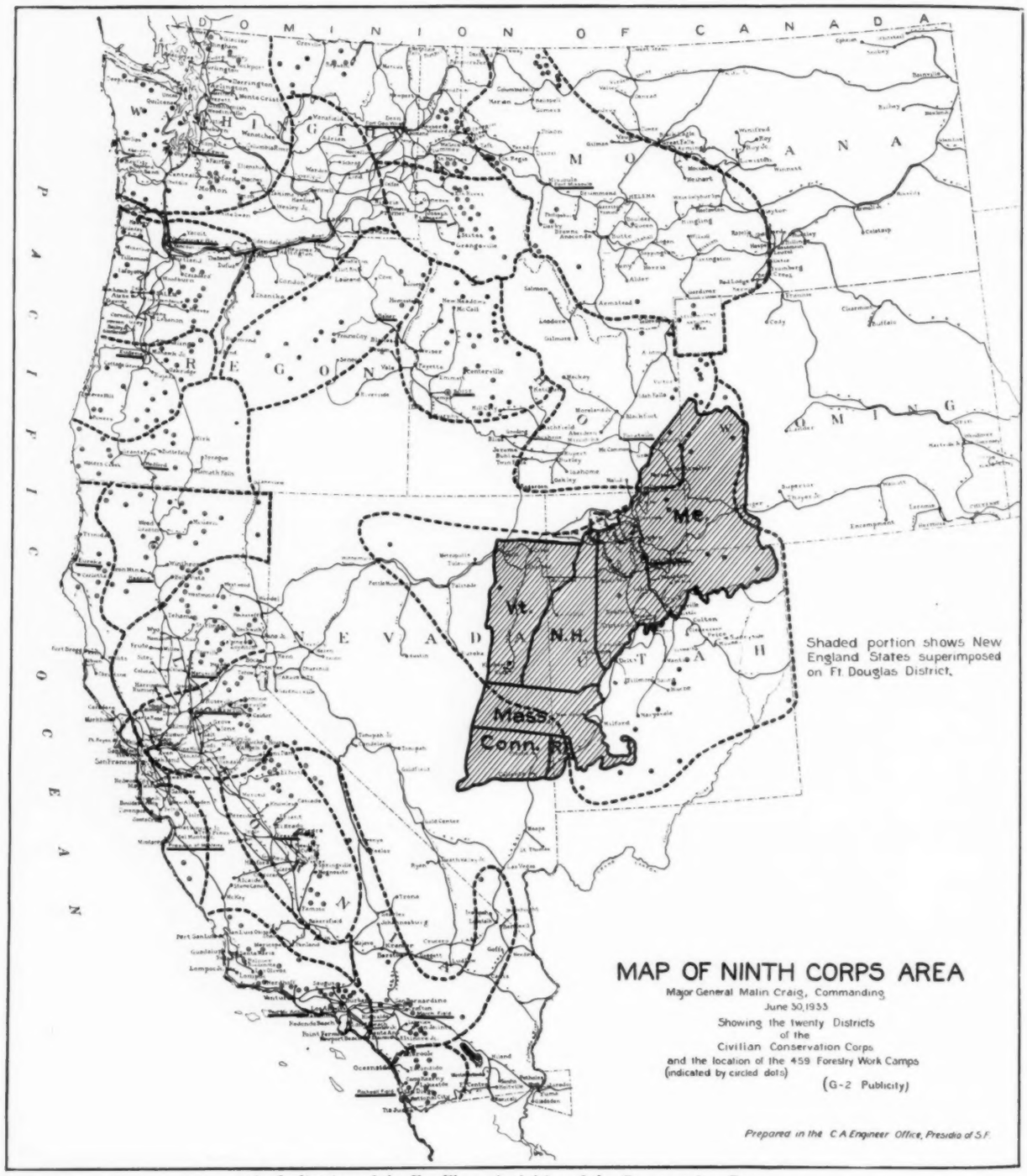
To the War Department the difference between the hope and the normal expectation was very real. To accomplish such an objective meant having the full number of men in hand by June 7, allowing two weeks for their reception and organization and one week for their transportation and establishment in camp. The task assigned contemplated the reception of an additional 222,000 men by June 7, at an average daily rate, if initiated by immediate decisive action, of 8,540 men, the complete organization and equipment, including the necessary motor transport, of approximately 1,200 additional company units by June 24 at the rate of 27 per day and the establishment of approximately 1,300 work camps by July 1, at the rate of 26 per day.

The rate demanded of 8,540 men received, processed and equipped per day was greater than the average for the United States during the World War for both Army and Navy combined. With all the vast organization of the Selective Draft, the many large divisional cantonments, a nation's purse wide open and the removal of many restrictions governing contracts, an average rate of 15,000 men per day obtained for only two months during the war period as the peak.

With men coming in at the rate of 8,540 men per day, there would be approximately 60,000 men in reconditioning camps at the end of the first week, 120,000 at the end of the second week and, if none were moved, 180,000 men at the end of the third week. The capacity was 100,000. The men would have to be moved out to work camps promptly within ten to twelve days. The flow of men in and units out would have to be as uniform as possible. At that time it appeared that it would be necessary to transport 155,000 men outside of their own states an average distance of 2,200 miles. They would have to be completely clothed and equipped to be self-sustaining units with the necessary motor transport so that when set down at some distant railhead they could eat and move. Their supply, therefore, was the critical element entering into the problem. There could be no delays. Requisitions for supplies at distant points, notifications of efforts of the federal coördinator to procure surplus stocks, materials being advertised for bids could not equip a unit with the necessary dispatch and did not meet the situation. War-time authority for open market purchases was necessary. Wider authorization to subordinates to sign vouchers for services and supplies had to be given upon which payment would be made without question, necessity being the only governing consideration. Certain restrictive Executive Orders governing procurement would have to be rescinded. The wide authority granted the President by the Act of Congress, Public No. 5, 73d Congress, March 31, 1933, would have to be exercised with war-time vigor and freedom, waiving all the restrictions of peace-time procedure governing bids, contracts, deliveries and open market purchases. Repeated conferences relative to the purchase of trucks and the use of obsolete equipment would have to be translated into immediate authority to the Army to purchase 2,700 light trucks, 300 light passenger cars and 250 ambulances.

CONSTRUCTION offered no problem other than that of increased expense. If men were to be jammed through our reconditioning camps filling them to a peak load of 100,000 men, more than twice the costs would result for shelter than if the rate of selection were cut one-half. Again peak loads at reconditioning camps would overload station hospitals requiring the use of civilian hospitals at greatly increased cost. A higher sick rate was definitely to be expected.

By May 10 approximately 1,060 projects had been approved. An additional 250-300 would be required. These would have to be approved and made available to the War Department by June 1, 1933, if the plan was to be a success.


DOMINION OF CANADA
PACIFIC OCEAN
Me.
Vt.
N.H.
Mass.
Conn. R.I.
Shaded portion shows New England States superimposed on Ft Douglas District.
MAP OF NINTH CORPS AREA
Major General Malin Craig, Commanding
June 30,1933
Showing the twenty Districts of the Civilian Conservation Corps and the location of the 459 Forestry Work Camps (indicated by circled dots)
(G-2 Publicity)
Prepared in the C.A.Engineer Office, Presidio of S.F.

**An Indication of the Far Flung Activities of the Conservation Corps.**

At that time the distribution of approved projects indicated that a vast movement from east to west would be involved. Approximately 155,000 men for whom there would be no work provided within their own states would probably have to be moved. Jobs for 95,000 of them were in the Rockies and the Pacific Coast ranges. It then seemed probable that most of the additional projects would be in the same region. The center of mass of these 155,000 men would be in Ohio. The center of the work would be in Nevada. In the space of four weeks an army of 220,000 men was to be recruited, organized within six weeks and moved (150,000 of them) within seven weeks a distance of 2,200 miles. Few military campaigns have equalled such a performance. To the Army it offered a real opportunity.

Its fulfillment would require the immediate issue by the Director of a national plan directing in detail all movements to be made or his decision authorizing the War Department to move units to all approved projects without further reference to him. It would require that no limitations be placed on the enrollment in any state or corps area of the quotas already set so that all corps area commanders might exert the maximum effort to process, organize and move their full quotas smoothly and on time.

In such an effort so closely approaching war-time condi-

tions, confusion and hardship were bound to obtain. Men would not be completely equipped; food initially would often not be well prepared; an eight-hour day could not be observed in the early efforts of moving from railhead to camp and establishing camp. Fatigue would be great; morale would be low. The basic faults of organization and discipline in the Civilian Conservation Corps were bound to create difficult situations for the various commanders to handle. The system did not sufficiently support them. A unit of 200 men all receiving the same pay, recognizing among themselves no seniors, is faulty in the extreme. A system that provides no proper basis of discipline, without delegated power to fine and to punish, could not cope with the situation. It was apparent that an Executive Order was necessary providing for increased pay and grade for a definite group of foremen among the men and authorizing the application of disciplinary methods and the conduct of hearings upon offenses with authority to company commanders to fine up to three days' pay per month. Similar conditions have made necessary such a solution in military commands. This effort closely paralleled an army in the field. Many complaints would come in. Investigation, however, would normally have to be waived or delayed. The Corps Area Commander would need all the help that could be given him and should be harassed as little as possible.

From the above considerations it was evident that an effort carried out in a war-time way would cost war-time prices. This rapid mobilization would mean higher costs for shelter, hospitalization, clothing, motor transport, and supplies of all kinds.

ON this estimate of the situation, the War Department concluded that it could fulfill the task proposed, provided: *a*. Decision was made at once to order its execution; *b*. The Director would issue at once a national plan indicating all movements to be made or else delegate to the War Department authority to order units moved to all approved projects; *c*. The Director would approve before June 1 an additional 290 projects; *d*. The Director would rescind his instructions to the Secretary of War in letter dated May 1, 1933, secure the cancellation of the Executive Order of May 8, 1933, and obtain the signature of the President on an Executive Order before May 15 waiving all peace-time restrictions covering bids, contracts, deliveries and open market purchases and authorizing the exercise of the fullest possible freedom in purchase, similar to that obtaining in time of war; *e*. The Department of Labor would initiate at once and maintain a flow of 8,540 men per day certified for acceptance to the War Department, completing its selection of the full number by June 7, 1933; *f*. The Department of Labor would regulate that flow according to the approved quotas evenly by corps area and by state throughout the period so that each corps area could meet its proportional part of the task on time; *g*. The Director would have transferred to the War Department at once $46,000,000 to cover its expenses up to July 1, 1933.

The War Department felt that it would be greatly aided in its task by an Executive Order authorizing that not more than 5 per cent of men be paid $45 and that not more than an additional 8 per cent be paid $36, and definitely delegating the disciplinary powers outlined above to the company commander.

It was evident that to speed up the effort to almost six times its former rate would require action and decision, that the delays, the conferences, the repeated reference of details to the White House and to the Secretary of Labor, the bickerings over every requisition for funds, the petty interferences to placate the selfish and to quiet the solicitous could no longer govern the effort.

With less than 40 hours available from the notice of the Director of his desires until the time for submitting the War Department plan to meet this task, the three sections of the General Staff assembled data during the daylight hours of the 11th of May and that night a lone officer assembled it in a memorandum to the Director of Emergency Conservation Work, giving the facts here presented, drawing the conclusions here stated and closing with the recommendation which a sleepy-eyed girl pounded out on her typewriter at 2:00 A. M., May 12: "It is therefore recommended that if the decision is to place 274,375 men in work camps by July 1, 1933, the Director give the War Department its full mission at once, provide the means for its accomplishment and then protect it from all interference. The means to be provided are: 1. $46,000,000 to be transferred at once; 2. An Executive Order waiving restriction on purchases; 3. The necessary instructions to the Department of Labor covering selection."

AT the Director's conference at 10:30 A. M. the War Department memorandum met immediate support from all members of the Advisory Council and strong recommendation was made to present it at once to the President. Shortly after noon it was in Mr. Howe's hands with the Director's Council crowding his room. Advisers were called. They were as one in stating that if the job were to be given to the War Department it would need the powers sought. The Director of the Budget arrived and after reading the memorandum announced to Mr. Howe that it was a matter of higher policy that only the President could decide, that the task unless modified would require the means the Army proposed. Mr. Howe and Mr. Douglas went in to see the President and a few minutes later, at 2:00 P. M., came out with his approval.

It was a momentous day. In a few hours more had been accomplished than in the previous month. A clearcut decision on a definite plan to fulfill a task the complete definition of which was positively ordered electrified the whole effort. The old order had changed. That afternoon all Assistant Chiefs of Staff, and Chiefs of Services met in the office of the Deputy Chief of Staff. The new mission was given, stirring everyone. Plans and action for the field were required by the next morning. That night instead of a stray light here and there the War Department's windows were ablaze. The big machine was rolling in a war effort. The Army was under test but what a grand opportunity the task offered.

From that day to this when the successful completion of the assigned task is reported all effort has been devoted to its execution. The conditions that the War Department set as necessary were all met; friction and delay ceased, accomplishment only fills the record.

On May 16 enrollment jumped 5,890 men to a total of 62,450, the next day added 8,100 men, the next, 10,500. On June 1 a peak daily enrollment of 13,843 men was reached. The average daily gain in actual strength for this period was 8,700 men. During part of May, 150,000 men were in reconditioning camps being organized and equipped for the field. More than the quota of 274,375 men were enrolled. Of these, after deducting losses from all causes, some 250,000

now occupy 1,330 work camps in the forests of the country; 55,000 men in 335 companies were transported from the eastern corps areas to the mountains of the Ninth Corps Area.

SOME conception of the undertaking can be gained from the following brief report of The Quartermaster General which pictures some of the high lights of his effort:

"The task of the Quartermaster Corps of the Army, in connection with the enrollment of the Civilian Conservation Corps, is to feed, clothe, equip, shelter and transport the young foresters. To do this, all Quartermaster Corps facilities have been taxed to the utmost, particularly during the peak of the enrollment in the last week of May and the first week in June.

"In performing this service, the Quartermaster Corps made the fullest possible use of existing Army stocks of clothing, bedding and tentage. Military uniforms, of course, were not suitable for issue to the civilian members of the Conservation Corps. However, it was possible to alter this clothing so that it was not of a distinctive military appearance and to issue the clothing so altered to the foresters.

"It was also discovered that the Army possessed considerable stocks of underwear and outer clothing too large for the forestry recruits. This clothing was cut down to meet requirements in smaller sizes. Although the peak of the enrollment was in the early summer, it was found that at many work camps cold weather was encountered and that overcoats were necessary. Military overcoats were altered to make them suitable for civilian wear.

"Alteration of this clothing was done very largely at the factory of the Philadelphia Quartermaster Depot. Civilian contractors hesitated to bid on this class of work. It was fortunate that the Army had a facility available to perform this work with sufficient rapidity to meet the needs of the Conservation Corps. The personnel at the factory was increased from 854 to a peak of 2,004 during the greatest rush. Alterations were made at the factory on nearly 200,000 wool coats, 225,000 overcoats, and 200,000 trousers. At the depot about 100,000 barrack bags were made, and the manufacture of tents is proceeding at the rate of 75 per day.

"The Quartermaster Corps also awarded contracts for the purchase of 2,500,000 yards of denim, 785,000 summer drawers, 185,000 denim hats, 1,000,000 jumpers, 28,000 overalls, 700,000 denim trousers, 525,000 wool trousers, 1,150,000 summer undershirts, 500,000 pairs of shoes, 250,000 canvas cots, 475,000 bath towels, 685,000 face towels, 300 motor ambulances, 300 passenger cars, 3,000 motor trucks and large quantities of other items.

"Each day the Army expends nearly $85,000.00 to feed the hungry forest workers. The foresters are given the same food supplied the Regular Army soldiers. Much of this is purchased locally in the vicinity of the work camps. Each day these civilians consume the beef procured from about 330 steers. Each day they eat nearly 225,000 one-pound loaves of bread.

"The men are sheltered for the most part in tents, but in some points where cold weather is expected early in the fall, as, for example, in Maine, it is contemplated constructing temporary wooden barracks. Most of the tents in use are floored. Arrangements are being made to pipe water into the camps from springs or streams or to sink wells. Water heaters are being provided for the shower baths. It is planned to furnish electric lights either by connection with nearby power lines or by the installation of small generating sets.

"Movements of foresters from point of enrollment to conditioning camp were made largely by regular and special railway trains, though for local movements and very short trips busses were sometimes used to carry the men to the Army stations where they were equipped and prepared for dispatch to work camps. Movements of work companies to forests were made almost entirely by rail. The greatest movement was from conditioning camps in the east and the middle west to forest camps in the far west, particularly in the states of California, Washington, Oregon, Idaho, Montana, Wyoming, Utah and Nevada.

"Transportation of foresters in cases where the point of departure and the destination were in the same Army corps area was handled by the Corps Area Commander who made all necessary arrangements with the transportation companies. Movements from one corps area to another and movements within a corps area when sleeping car accommodations were involved, as, for example, in Texas and other points in the Eighth Corps Area, were handled by the Quartermaster General. During the enrollment period, 211 special trains were handled by the Quartermaster General. These trains carried a total of 64,196 men in 1,605 sleepers and coaches. Of the total number thus transported, 55,130 were sent to the Far West. Approximately 200,000 conservationists were sent to work camps in the vicinity of the points of enrollment."

THE mobilization of the Civilian Conservation Corps with time as the essential element in the execution of the task has been the most valuable experience the Army has had since the World War. It has tested the organization of the War Department and of the Corps Areas in responding to a mission very similar to mobilization for war. From results vastly superior to those obtained during the early period of the World War certain conclusions are inescapable. They are:

*a.* The General Staff has justified itself as a planning agency. It has foreseen every call made upon the War Department for participation in the Emergency Conservation Work program and has been ready to direct the immediate response to every such demand.

*b.* The organization of the United States into Corps Area Commands has proved sound. The ability of the Army to take so huge a task in its stride scarcely attracting the attention of the country or of the press has been due to the decentralization of effort to nine small war departments, each more efficient than that in Washington at the outbreak of the World War. Thus the General Staff has supervised and coordinated, announcing basic policies to govern, setting forth missions, providing needed assistance but delegating execution of all details to the nine Corps Area Commands, and refraining from all interference therein.

*c.* The war stocks of equipment of all kinds gave ample testimony of the need to maintain such reserves. The speed with which units were organized and dispatched could not have obtained without kitchen ranges and gear, mess kits, tentage, bedding, clothing and the like ready in stock for immediate issue. In many items the Civilian Conservation Corps practically exhausted that reserve and had the numbers been greater embarrassment would have resulted.

*d.* It is necessary if the Army is to exert its full power of accomplishment in any emergency that it be given a clearly defined mission, the means and the authority to execute it and be protected by the Executive from all interference.

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## *Month by Month*

THE grand scramble to share in the distribution of the $3,300,000,000 public works program is on. Every conceivable type of public and private organization, it seems, is making application if it has not already done so. At this writing the so-called Army program, which in its original form as submitted by General MacArthur, Chief of Staff, requested an allotment of $300,000,000 and which was later trimmed at each successive stage of the clinical examination by the Public Works Board, is in abeyance. Other than the immediate consideration of an item labeled ammunition requesting $13,000,000 primarily for the continuance of operations at the ordnance arsenals and depots, the remainder of the Army project proper is at a standstill. The $13,000,000 ammunition item, of which $6,000,000 was personally authorized by the President, was merely one item of the larger program and was an emergency matter of first importance. Due to budget reductions under the regular annual appropriation, ordnance cuts were so drastic that without this emergency relief arsenals and depots were faced with severe curtailment. Elsewhere in these editorial notes we have endeavored to state the case for the ordnance civilian engineer and the arsenal employee.

ORDNANCE AND THE PUBLIC WORKS PROGRAM

In the larger program ordnance, of course, will have a goodly share if, as and when executive approval is given. Mechanization and motorization of the Army are essentially ordnance operations and for these functions something in the nature of sixty to seventy million dollars would be provided for modernization activities. It is difficult to name any major undertaking worthy of approval by the Public Works Administrator which surpasses an ordnance program for the relief of unemployment. It is impossible to name any one proposed item which excels it in permanent benefit to the country. These two objectives are met so fully and so advantageously by the motorization and mechanization program that excepting only the naval program to build-up to long neglected treaty limitations one will look in vain for more deserving public works.

Indeed there are employment relief aspects of the mechanization and motorization schedule which other public works do not have but which nevertheless are of first importance. A production program of new equipment for the Army would mean that engineers and mechanics both in the Government arsenals and in many of the basic and secondary industries would be given constant employment. There are no seasonal variations in ordnance manufacture. Whereas the building of roads, buildings, bridges and even boardwalks and swimming pools are best prosecuted only in good weather, our factories and machine shops can begin at once to produce ordnance and employment would be continuous day in and day out. We repeat what has been emphasized in these columns that, just as the Navy program is predicated upon a distribution to labor of 85 per cent of the funds spent, so too the Army program would pay the same if not a larger dividend.

One of the striking features of building ordnance as a double relief measure is apparent in the geographical distribution of the work to be done. There is scarcely a state in the Union which would not feel the effects whether they be in the raw material commodities or in fabricated equipment or in assembly. Visitors to the Army exhibit at the Century of Progress exposition when viewing a modern antiaircraft gun will, on second thought, realize that in its making materials are gathered from the four corners of the nation and that its cost is distributed to the same areas.

Over and above all this, the motorization and mechanization program has more than the immediate relief of unemployment in its favor. If the program is embarked upon it will give us an up-to-date Army which, in point of matériel and equipment, is badly needed. As we go our way in civilian life trading in the old radio and automobile for current models some of our people seem to forget that weapons are but a byproduct of modern invention. Ordnance styles have changed just as radically as have the everyday commodities of peace time. Ordnance of 15 years ago can no more do today the job for which it was intended than can the hot-air furnace or the old icebox stand up against latest rivals. Much of our present-day military equipment was gotten together in the rush and tumble of the World War. It has already lived a normal lifetime and it cries for retirement and replacement by the new generation of up-to-date and more efficient successors.

The question squarely put is this: Will the Public Works Board utilize the employment relief facilities of the mechanization and motorization program, which ranks on a par where it does not exceed many other programs for this purpose? Will the Board enable the United States Army to clean out its collection of antiques and replace them with latest models? If it will, then steady employment will be assured for a long time to come and, equally important, we will have equipped our skeleton Army with the newer designs. It seems entirely fitting to observe that with a Navy modernized as it should be, the administration of public works will have missed a long bet if the Army is condemned to carry on with its obsolete and obsolescent equipment. All friends of national defense will join in the hope that this double-barrelled opportunity for real achievement will not go unheeded. Hacks went out of style with

the Victorian era; so did a great deal of the equipment the Army still uses. The quicker we replace the old with the new the better.



THE magnificent performance of the Army in handling the mobilization of the Civilian Conservation Corps with a smoothness and precision almost beyond belief is made additionally conspicuous by the lack of public appreciation it has received. As far as the Army itself is concerned, that this is so is of no consequence. The military service can point with pride from the very beginning to the modest way in which it has accepted the job in hand, whatever it be, and followed through to successful conclusion. The Army does not ask for plaudits for the simple reason that it is unaccustomed to them. Yet one can not read the account published in these pages by Colonel Major of the methodical, rapid and significant mobilization of the Conservation Corps without insisting that the Army take a bow. Local news hawks have been noticeably absent in the applause. The efficient movement of nearly 300,000 men into and through conditioning camps and their movement to and management in the national forests has been conducted by the Army with scarcely a ripple in our everyday affairs. Things had gotten to the point where this undertaking was worthy of the daily headlines only when an occasional handful of youngsters demanded ice cream for desert on the camp menues. Our people have become so accustomed to the operation of great underlying forces that the effort registers only for a day.

GIVE OUR LITTLE ARMY A BIG HAND

Few realize that in the mobilization of the Civilian Conservation Corps the Army handled a job which was greater than our entire manpower effort of the Spanish American War. Strange as it may seem, more men were mobilized without hubbub or commotion in the short space of three months than were handled in the first three months of the World War. They were assembled, conditioned, organized into some 1300 companies and distributed to forest camps spread from ocean to ocean. Now the men are at work in the forests with the Army but not in it, with military discipline but not under it, with bed and board and recreation and not a rifle in sight. This job assumed by the Army overnight, so to speak, and carried out so expeditiously, adds another wreath of laurel to the military record. Only the officers of the Army and Navy and the enlisted men of the Regular Army who have directly prosecuted the work know what a great task it was and is. As a matter of record it is of especial interest to note that today there are 5442 officers and 8000 Regular Army enlisted men on duty with 274,000 conservationists in the reforestation camps. The officer personnel consists of the following: Regular Army (other than Medical Corps and Chaplains) 2875; Medical Corps, 116; Chaplains, 22; Navy and Marine line officers, 297; Navy Medical officers, 207; Reserve Officers (other than Medical Corps and Chaplains), 1,093; Reserve Medical Officers, 507; Reserve Chaplains, 32; Contract Surgeons, 267; Navy Dentists, 6; Dental Reserve Officers, 20. All Army service schools except the Army War College, Industrial College and the Air Corps Tactical School were closed May 22nd to release students and 60 per cent of the faculties for Conservation Corps work.

It was a happy selection in more ways than one when the Army was given this job to do. For one thing a permanent Government institution which knows best how to handle and provide for men in large aggregations was the logical instrument. For another it has been shown that the Army is ready at the drop of the hat. This mobilization was as fine a manpower maneuver as any peace-time army could ever hope to have. To come through it successfully is a feather in any army's cap. To have done it with very little talk, with no excitement and in double-quick time is proof that our military organization is at high efficiency. And to have been given the chance to show 300,000 young Americans, far too many of whom have been taught to look upon our Army as only a destructive machine, is a piece of constructive citizenship and Americanization which will do great good in a thousand ways. If it so happens that our little Army has not been given the big hand its performance deserves, there are nearly a third of a million new friends in the camps and possibly a hundred times as many on the sidelines who now insist that our military establishment take a bow.

General Malone, Commanding General of the Third Corps Area, has estimated that at the end of six months three hundred tons will be added to the weight of the conservationists and that their health, strength and vigor will be immeasurably improved. If respect and admiration could be measured in some kind of unit we hesitate to predict the regard and esteem the Army will have added to itself for its constructive, statesmanlike efficiency in gathering and administering to its fellow citizens. It should give a mighty comfortable feeling to all of us. The youthful citizen of east-side Manhattan who last winter stood in the bread line and today earns his way in the forests of Yellowstone Park has the President and the Army to thank for the business-like way in which his transition was effected. So let's give our little Army a big hand!

THE American public will be denied until later in the year the memoirs of the Right Honorable David Lloyd George which will appear in book form in the fall and extracts of which are now being published serially in the *London Daily Telegraph*. From the installments which have thus far come to our notice we are tempted to observe that the mind of the politician in England operates along the same path it proverbially follows in America. This observation grows out of the criticism which the former Director of Munitions in Great Britain hurls at the British Army and the sins of omission in peace time which he heaps upon its head. The former premier does not mince words in his caustic arraignment of the war office when he accuses it of not maintaining sufficient reserves and equipment in time of peace and of its "mental obtuseness" in the neglect to keep abreast of modern development in pattern of munitions. He says that the war office neglected to use its powers to the full to remedy the lamentable ammunition shortage when it was apparent and that the "big industrialists" were kept at bay when their services should have been utilized.

MR. LLOYD GEORGE WRITES OF MUNITIONS

Already former members of the British Army have refuted the Lloyd George accusations and to good effect. We

are not so much concerned about the weight of the evidence for either side because a correct recording of history of these events is the task of those who were directly involved and whose ability and name may be at stake. Until the memoirs appear in book form, at least, students will withhold a final verdict.

Thus far, however, the analogy between the American and the British systems of national defense is perfectly apparent from what Mr. Lloyd George has written. If in some cases the names of American Army officers were substituted for those of English officials to whom the former director of munitions refers the record would read as though it were a description of conditions here. Strange as it may seem, we in America continually have the same situation to deal with. Seldom in our history has a politician assumed command in an emergency but that he berated the Army for having allowed an unfavorable condition in the supplies and equipment of our military forces to arise. The few exceptions could be named on the fingers of one hand. As though the military mind were soundly asleep on the job and the pseudo-statesman is the one to discover it. A very interesting commentary might be written on our own national experience on this very subject. The record would disclose that Army officials charged with the responsibility for maintaining the reserves of ammunition and equipment have appeared before unappreciative budget officials and Congressional committees presenting facts and figures year after year. A deaf ear is turned to such appeals until in the course of time they are dropped as not worth the lost motion they entail. But when the horizon darkness and the unschooled administrator or legislator decides that an army will be needed, then, as Mr. Lloyd George did and now records, the complaint is registered that the army has not kept itself in condition to assume its appointed task. We have experienced this time and again in our own country and what Mr. Lloyd George has written only serves to emphasize the experience. When he charges that the shortage of ammunition was not realized sufficiently in advance he is entirely forgetful that the military authorities in England in the early days of the war were after immediate results. Their way of doing it was to place large orders with American firms and to use the facilities of their own government ordnance factories and the usual recognized armament firms. When Mr. Lloyd George did bring in the great industrialists he was able to do so because by that time the entire nation was mobilized in fact and opinion to undertake the task. At that, however, this form of speeding-up process had its drawbacks because there had been no munitions education beforehand and the quality of product obviously suffered.

JUST what will be the ultimate outcome of the executive order reorganizing Governmental activities in its effect upon the procurement functions of the War and Navy Departments appears to be unknown.

CONSOLIDATED FEDERAL PROCUREMENT

Under that order all procurement, warehousing and distribution functions now exercised by the staff branches of the Navy and the supply branches of the Army were to be transferred to a procurement division of the Treasury Department effective August 10.

The centralization of disbursing activities in the Treasury under the order would eliminate this function from the Chief of Finance of the Army and the Paymaster of the Navy. Where the reorganization treads on thin ice, however, is where it intimates the removal of procurement functions from the defense services. In this respect the executive order reads, "The function of determination of policies and methods of procurement, warehousing and distribution of property, facilities, structures, improvements, machinery, equipment, stores and supplies exercised by any agency is transferred to a procurement division in the Treasury Department at the head of which shall be a director of procurement." What seems to us to be saving clauses, insofar as Army procurement is concerned, are contained, however, in the following part of the order, namely, "In respect of any kind of procurement, warehousing, or distribution for any agency the procurement division may, with the approval of the President, (a) undertake the performance of such procurement, warehousing, or distribution itself, or (b) permit such agency to perform such procurement, warehousing, or distribution, or (c) entrust such performance to some other agency, or (d) avail itself in part of any of these recourses, according as it may deem desirable in the interest of economy and efficiency. When the procurement division has prescribed the manner of procurement, warehousing, or distribution of anything, no agency shall thereafter procure, warehouse, or distribute such thing in any manner other than so prescribed." Observers hope that the new director of procurement will utilize the second alternative at his disposal, namely, that he will permit the Army and Navy to continue to perform their present procurement, warehousing and distribution functions. If it should be otherwise serious harm will be the result.

There is one outstanding lesson of our military history. It is the great accumulation of evidence before, during and after every major war pointing clearly that the supply of military and naval equipment is not a run-of-the-mine job. In the case of the Army that lesson was reviewed and consolidated once and for all in the National Defense Act of 1920, the most comprehensive, time-tested and efficient organic law our military organization has ever had. It broke away from older prejudices when it dealt specifically with the question of procurement. It went so far in its effort to solve this age-old military problem as to set up a special office in the Army organization, the prime purpose of which is to see to it that procurement will never again be a military bugbear in another major war. The Assistant Secretary of War under the National Defense Act has the specific duty of planning for and administering procurement. Under his direction a staff of experts are continually at work. Their studies for procurement planning are current and complete. There has never been a time when the ways and means of getting the things an Army needs for efficient operation in war were so exhaustively planned. If all this is to be scrapped the efficiency of our Army will drop back to where it was in 1895.

We can not believe that the executive order proposes any such retrogression. If the worst comes to the worst and the director of procurement undertakes to handle the Army and Navy munitions requirements just as he will the typewriters, carbon paper, paper clips and pencils of the huge Government machine, we feel sure that he will, after a fortnight of experience, drop the assignment like a hot

brick. He will realize very quickly that of all the specialized planning for procurement that of the Army and Navy is in a class by itself and requires a knowledge and experience which only the Army and Navy have.

According to latest information the proposed task of consolidating all Federal procurement is acknowledged to be so great and so much study and investigation are required that the Treasury Department will ask the President to delay the effective date for several months at least. When these studies and investigations get further advanced there can be no doubt that the procurement functions including industrial war planning of the Office of the Assistant Secretary of War as provided for in the National Defense Act will remain right where they now are. Any official who has the temerity to root them up will be guilty of the charge that our World War munitions experience has gone for naught. That indictment, we are confident, cannot apply. Only an army itself can undertake to guarantee that it will have what it needs to accomplish its mission. It was bad enough in the Spanish American War when the then Colonel Roosevelt entered in his diary "What we ask for by express the Ordnance Department sends by freight; supplies that could come by freight arrive by express." Improvement in War Department organization has changed all that. There is danger in the proposed consolidation that the uninitiated, not being specialists in military procurement, may send by parcel post underwriter approved fire extinguishers when fire-control instruments are wanted in battle, or possibly decide that shrapnel is what the commander really ought to have when he has called frantically for H. E. shell!



IN mid-July when the daily press gave prominence to a tempest in a teapot between the Public Works Administration and the War Department as to whether the Army would be allowed to share in the public works funds, observers were amused at the clumsy finesse attempted by the oppositionists. For instance, the *Washington Post* in its issue of July 19th said, "The controversy over the Army program was said by some to have been based upon the views of some members of the Public Works Board that it would not meet with the requirement that all projects financed under the construction fund should be 'socially beneficial.'"

"Not Socially Beneficial"

If this reporting is accurate, and there are indications that it may be, where, may we ask, lies the line of demarkation between governmental projects that are a social benefit and those that are not? A country not forgetful of its traditions which still maintains a reasonably sound outlook on national defense is always subject to reproach from some of its pacifistic citizens within the gates. These reproaches are not new either in form, method or disguise. But none of them heretofore has had quite the foolhardiness of a veiled attack on the grounds of social benefit. To object to national defense on this score is begging the question and would be extremely amusing if it were not so serious.

Some of our well intentioned fellow countrymen may look askance at what the Army has done for the nation since the days of the French and Indian wars and, in spite of our progress, maintain that there was nothing socially beneficial about it. If so, then it follows that the Revolutionary War accomplished nothing of social benefit nor did the War of 1812 nor did the Mexican War, the Civil War, the Spanish American War or the World War. Likewise, there was no social benefit in the hundreds of possible wars which the mere existence of our defense forces prevented from becoming actualities. There may be differences of sound opinions on the relative achievements of each of our past conflicts but there can be no doubt that if we had not had our fighting forces such as they were there could have been no social benefit whatever. To bring the case closer to the present day, one wonders how it can be that two hundred odd million dollars of public works funds are allotted to bring our Navy up to nearly treaty strength and at the same time deny modernization to the Army on the social benefit theory. Fortunately the President himself is the final arbiter in the matter and judged by what he is doing for the Navy he has no such warped idea of social benefits. When the Army program ultimately comes up for decision friends may rest assured that it will not be turned down on any such flimsy grounds.

To stigmatize the national defense by classifying Army expenditures as not "socially beneficial" is pink nonsense! We would expect it from certain elements in some of our larger universities where pacifism is rampant just as we expect it from the great propaganda organizations which flood our country with pacifistic doctrines as fast and as thick as the printing presses and multigraph machines can grind them out. We would expect it too from the editors of some of the religious denominational magazines and possibly from some of our pulpits. From such sources we have accustomed ourselves to take these things with a smile. We do not expect it though from any public officials who for the moment control the purse strings. They know as well as every other unbiased student that before there can be social benefits at all there must be a people and an organized government to enjoy them, both of which connote a national defense.

It looks as though the Army is so basically a part of the roots of the country that its very presence is forgotten. Yet those who are looking for social benefits and the best way of spending money on them are mistaking a good of the greatest consequence for an evil. It is hard to figure out how the mistake can occur once the social benefit of battleships and cruisers is admitted. This much can be put down without contradiction, nevertheless, and it will be vouched for by all sensible Americans: every dollar spent for reasonable national defense could not be expended for any possible greater social benefit.

ECONOMISTS and sociologists are beginning to draw their curves showing the effect of NIRA on the commercial structure of years to come. The new outlook has taken root so quickly and its effects are so ramified that not even the first names on our lists of students of economics are willing to draw the picture of the ultimate effects. Business by code versus business by *laissez faire* will in any event change things very materially. We are headed for new concepts of business where quality and service will be the determining elements.

Industrial Preparedness Under the New Order

Such a change will not be effected without basic modifications of production and distribution policies. Students of industrial preparedness can not overlook the possible effects of the new order.

Where war planning has been and is on the basis of operations of last year or the year before it will now take into account the new conditions as it finds them. We have every reason to believe that the planning authorities of our national defense services will keep abreast of the changing order. If they do not then our plans will not be worth the paper they are written on. We hope that the Army Industrial College and the office of the Assistant Secretary of War will be kept in close contact with the operations of the Recovery Administration. It would be preferable if these planning groups could watch NIRA at close range. There is all the difference in the world between planning and study based on what the War Industries Board did in 1918 and what NIRA is doing in 1933. All signs point in the direction of industrial war planning in which the Defense Act will be the foundation and NIRA the superstructure. What the effect will be on production schedules so many months after M day is anybody's guess. It will not be a change in production facilities as much as it will a change in method of administration but that change has an important bearing on industrial preparedness—maybe to complicate it for a time but ultimately to facilitate it greatly.

THE collapse of the London Economic Conference has overshadowed the summer activities of the Disarmament Conference which is in recess until October. While some of the "experts" of the Disarmament Conference are still studying phases of the various problems before them others, notably Mr. Henderson, Chairman of the Conference, are traveling about the world mainly, it appears, in search of one thing or another. Our own Ambassador, Mr. Davis, and his technical advisor, Mr. Dulles, are back at their native haunts near the lower end of Manhattan having abandoned all plans for informal arms reduction negotiations until autumn convinced, according to the Associated Press, "that nothing could be done in the meantime to reconcile the prevailing and persistent disagreements on this vexing question." The chairman of the conference is calling on the heads of the various European nations during the summer in the apparent belief that a little salesmanship, after the fashion of the old time drummer, may help to sell the customers. This tour impresses us as a midsummer night's dream because, notwithstanding the forebodings of next fall, present reports continue to come from the worthy chairman about the great effect his personal solicitations are having.

MIDSUMMER NIGHT'S DREAM

The wily ways of the economic conference which, until a halt was called by our President, had the stage all set for the usual American trimming, have done more to awaken the American people than any other international activity of recent years. It looks very much as though the public mind has become aware of the sham and gloss of these so-called friendly gatherings, and its hopes for anything real coming out of Geneva in the fall are sub-zero. This is a fortunate circumstance and a good sign. The internationalist complex has taken hold of so many of our well meaning citizens that one has often had cause to doubt whether there was such a thing as a permissible sane nationalism left. But the horizon has changed rapidly. It is a part of the new order. In the wave to cut down government expenditures we might even urge the saving of the expenses of our delegates, intercontinental phone calls and transoceanic boat-rides.

When it gathers in October after the summer's adjournment the Disarmament Conference might very well put as its agenda the one item of permanent adjournment. This, one of the longest international conferences on record, has achieved nothing thus far and has little hope left. In 1899 the International Peace Conference lasted only three months; it was brought to an end by Germany's objection to the discussion of excessive armaments. The Conference of 1907 sat for four months. Both these conferences produced various conventions, three in the former and fourteen in the latter, most of which were violated in the World War. It is time, we take it, for every country to put its own house in order by its own means. All of us sticking more strictly to our own affairs, with good will for all, will very soon accomplish what stuffed shirt conventions can never bring about.

AS matters of passing interest during the lull in the Disarmament Conference we find that progress in armies throughout the world is going ahead apace. Reports are beginning to be published on the great maneuvers conducted by the French Army last fall in Champagne. It is said that the bulk of the French cavalry is being mechanized. This may be due to the fact that French industry now produces more than 200,000 motor cars a year and the production could easily be quadrupled. The number of army horses is to be reduced from 146,000 to 136,000.

WHAT OTHER ARMIES ARE DOING

From Russia come reports of a new mechanized army. Three hundred and fifty airplanes, more than half of them big new bombers, took part in the military display in celebration of Lenin Day while nearly 300 tanks darted across Red Square. These included 50 new amphibians, 110 heavy tanks and 12 "monsters" described as a new type, some of them mounting five guns. In the great display there was no mechanical breakdown.

News items of this nature take precedence over the continued debate in the London papers on the merits of cavalry versus the tank. Apparently it is not a time for theorizing as much as it is one of definite action. These inferences tend to show that mechanization and motorization are the accepted principles of modern armies and that he who ties his future to the older methods of transport and maneuver is decidedly out of date.

In the public works section of the National Industrial Recovery Act there is authority to expend funds for mechanization and motorization of our Army. Rumor has it that we will not embark on a large program until the Disarmament Conference has gone the way of the Economic Conference. After that, let us hope the United States Army will be in a position to show an admiring public a collection of tanks, trucks and planes at least comparable to those meeting such popular approval on the Continent. As Premier Mussolini said, "Now for an embargo on conferences."

# *Our Arsenals and Their Personnel*

**An Editorial**

UNDER the threat of administrative reductions of the Congressional appropriations for the Ordnance Department for the present fiscal year the small group of ordnance engineers and technicians at our arsenals and depots faced the most severe curtailment since the World War. To understand the full significance of what was about to happen to our centers of research, development and limited munitions production, one should have a clear picture of the appropriations situation for the past two years. Congressional appropriations for the Army, which include the entire military establishment, have been dwindling. For the fiscal year 1932 they totaled $334,764,748; for 1933 they were reduced $48,771,771, to $285,992,977. For the current year ending June 30, 1934, Congress further reduced the military appropriations by $16,319,624, to $269,673,353, a drop in appropriations within the two year period of $65,091,395, or approximately 20 per cent. Further budget limitations were put on War Department expenditures so drastically that the Congressional appropriation for 1934 was held to $192,177,199, a reduction of $77,496,154. At least this was the status of the program on March 28, 1933.

Notwithstanding the fact that these reductions were held in the closest secrecy and were ordered "not to be shown to others," the War Department was enabled by July 10, 1933, to have the ante raised so that a total of $228,797,199 was available for the military machine. Of this sum, nearly $2,500,000 was transferred from the funds of the Civilian Conservation Corps. But even that advantage left the arsenals and depots in a seriously precarious position. The Ordnance Department was threatened with the reduction of normal operating personnel numbering approximately 7,700 by nearly 5,000, leaving a mere 2,200 employees to carry on. Faced with a four day week during the month of July and thereafter the extinction of many activities and the severing from service of irreplaceable technicians, the President, at the solicitation of the Assistant Secretary of War, Mr. Woodring, authorized the allotment of $6,000,000 from the public works fund to help keep the arsenals intact. Later, and again due entirely to the ability and perseverance of General MacArthur, our clear-headed chief of staff, who appeared before the Public Works Board, another $6,000,000 was authorized for expenditure in the defenses of Panama and Hawaii. At this writing the effect of the second additional allotment on ordnance establishments is not known.

In any event the two "emergency" appropriations will assist very materially in preventing the shut down of our arsenals with the subsequent additions to the ranks of the unemployed and the irreplaceable loss of trained and skilled professional men. It is on the value of these latter that we propose to devote an exposition of the reasons why the threatened reductions would have been a calamity of the first order. As distressing and contradictory as such a reduction would have been when the relief of unemployment is being organized and attacked on a nation-wide front, and as unjust as individual hardships thus created in the ranks of ordnance artisans would undoubtedly have caused, there is still a third reason for a proper understanding throughout the land of the essential value of the ordnance engineer and artisan. When threatened reductions do not give this class of employees the priority which the national defense demands for them, then it is high time to restate the case for the benefit of any who may not be cognizant of the situation or who may have forgotten its importance.

THERE is one cardinal rule in the theory and practice of American munitions which can not be controverted. It is that arsenals and depots are our only training centers where the art of ordnance design and manufacture is kept alive. Destroy those training centers and research and progress will be nil. We make no claim that our arsenals and depots infringe in any way upon the place of American industry in the munitions picture. The arsenals with their very limited production facilities are the research centers. When the job has to be done on a big scale industry again will have to do it as was the case in 1917-18. The 7,000 odd employees of the Ordnance Department are a mere drop in the bucket to what their numbers were and would be again in the event of a major war. In 1918 there were 79,720 civilian employees in the department; to our knowledge no figures were ever compiled giving the additional number required in industry. In any event we know that our larger manufacturing arsenals quickly grew and expanded in their efforts to keep industry up to the mark on its part of the undertaking. To give the figures for the manufacturing arsenals alone, we find that in 1918 at Rock Island there were 10,384 employees; at Springfield Armory, 5,129; at Frankford Arsenal, 4,972; Watervliet, 3,361; Watertown, 3,018; Picatinny, 1,506. Here we have an indication of the possibilities which become actualities in war time.

There is an economic aspect of our arsenals which is not often taken into consideration. They represent a tremendous investment in plant and specialized equipment which, when it is not producing, represents a serious capital loss. Rock Island Arsenal alone, since its acquisition in 1862, has a nominal value of land $4,000,000, buildings and equipment $43,500,000, bridges $1,250,000. The reservation covers 896 acres. Springfield Armory with its 297 acres has a land valuation of $614,000, buildings and equipment $11,543,131. In the case of Watertown, there is a capital investment of more than $20,000,000 for land, buildings and equipment; Watervliet Arsenal approximately $18,000,000; Frankford, $25,000,000, and Picatinny nearly $8,000,000. The argument would be faulty if it went no further than to contend that this investment should be operated at any cost. It so happens, however, that its normal annual operating cost is only approximately 7 per cent of the invested capital, that is in terms of dollars and cents, while the return from an economic and "socially beneficial" viewpoint can not be measured in any monetary unit.

TO view the question in this light is to consider only the physical side of the question. A much more important element is the individuals who comprise the arsenal and depot organizations. They constitute a body of learning and application which can not be duplicated anywhere and if once allowed to fritter away can not be replaced. The

ordnance engineer and technician is a member of a profession which is a profession in the fullest sense of the word. That group stands side by side in value and influence with the professional soldier. Indeed members of that group constitute the backbone of an organization giving it continuity and permanence which the military profession lacks. With the Army officer it is a case usually of a four year tour of duty at an arsenal or depot after which he goes on to other assignments. For a while he will be with troops, then he may be at one of the Army schools and then in some administrative capacity and then somewhere else. With the trained ordnance civilian specialist it is a case day in and day out, year in and year out, of study and research producing a development around which grows the tradition and perspective so necessary to engineering progress. The achievements of these civilian specialists do not usually make the headline in the daily press. Yet in our government arsenals they are literally conducting "houses of magic" which rival the best engineering and research organization anywhere. To that group is due in large measure the success which has come to our entire munitions progress because its duty embraces the endless detail and ceaseless experiment which bring desired results.

ABOUT eleven years ago, say about 1922, the modern American ordnance problem became crystallized. The period from the close of the war until then was one of transition, the good and the bad of World War experience had been evaluated, the course for the years to come was charted. Older readers of this Journal may recall an analysis of the problem by the then Chief of Ordnance, Maj. Gen. C. C. Williams, which was published in these pages. Discussing the importance of the civilian engineer and technician he wrote, "The Washington office and the work at the arsenals and depots are the training system for the civilians. In time of peace they are not generally moved from one class of work to another. Their training, therefore, is a natural result of the work on which they are engaged. This condition is of great importance to the department for it is through the civilian force that the continuity of knowledge and experience which is so necessary to any endeavor, lives. Without a well trained civilian force, the Ordnance Department would be greatly handicapped. In other words we must maintain a reasonable amount of work at our arsenals and depots at all times to keep together the nucleus of this force."

The intervening years have accentuated the wisdom of that policy looked at both as a munitions program and as a national asset. Possibly from the latter viewpoint does the greater advantage accrue because the researches and developments at our arsenals have exerted a far-reaching influence on ordnance design and commercial practice alike. Consider the broad benefits of the aggregate knowledge in which civilian practice shares, that emanate from these ordnance establishments. At Rock Island Arsenal the design and limited production of artillery matériel, gun carriages, limbers, caissons, tanks and tractors are carried on. There are facilities for the manufacture and repair of small arms and machine guns. Likewise at Rock Island there are huge distribution facilities for issuing supplies to troops. Picatinny Arsenal is the Army's model experimental ammunition development and research establishment. Here are developed our powders, high explosives, metal components, loading technique and pyrotechnics. At Watervliet the manufacture of light and heavy guns and their accessories is carried on. At Watertown in addition to a world-renowned testing laboratory the activities include the production of seacoast gun carriages, railway mounts, high explosive and armor-piercing projectiles, steel, iron and nonferrous castings. At Frankford Arsenal the range of activities includes small arms ammunition of all types, fire-control and range-finding instruments, and gages for these components. At Springfield Armory the stock in trade is rifles, spare parts and bayonets, the repair of rifles, revolvers, machine guns and automatic rifles.

We have referred to the principal manufacturing arsenals only. Dotting the several states and possessions are depots from which supplies are issued to troops. All this is an intricate yet simplified machine to conduct an essential function. Like every other organization it is as good as the brains and application which make it work. It has functioned splendidly and it must continue to do so. The establishments under the administration of the Manufacturing Service and the depots and stations under Field Service are the arteries which supply the Army of the United States with the sinews of defense. Back of them is that body of trained engineers and artisans, specialists in a special profession without which our military defense cannot be. They deserve consideration for valuable service rendered.

IF we may be permitted to add a more personal note on behalf of our Ordnance personnel it is to call attention to the self-sacrifice which marks practically every individual case. Service as an Ordnance engineer or technician has one element in common with all other public service: it is not paid for at fancy prices. The remuneration received by this group is in no way commensurate with that obtainable in commercial life in normal times. We can find no other cause to account for the innumerable cases of a lifetime of devotion to a cause such as this except that it be devotion to an ideal. This is one of the reasons why Ordnance design and production becomes a special profession. Like the salt of the sea, the machining of a gun tube and the blending of powder have a way about them of tying the artisan to his job with an unshakeable attachment. Containing the attributes of all classes of engineering—chemical, metallurigcal, mechanical, physical and electrical—the Ordnance specialist, while versed in one or more of these, is also devoted to a cause more universal than any of them. It is probably in the latent possibilities of the things he produces from which this devotion grows. With such a feeling remuneration becomes secondary. Our arsenals have had their ups and downs with Taylor systems, time clocks and piece work, but they have never been found wanting in loyalty and concrete achievement. The personnel is content to go its way to do the best job it knows how that American munitions may be the gainer. Thus far the record is one of great achievement purchased by individual sacrifice which deserves the very best of a grateful government. The temporary prospect of major curtailment was sufficient to hurt morale almost to the breaking point. That morale will be restored and the work in hand will go forward. As a nation we would have rued the day when our few Ordnance establishments and their personnel were permitted to disintegrate. Happily the latest threat, on second thought, did not materialize and the Nation is that much better off.

# Association Affairs

THE changing administrative panorama in the tremendously important activities of the Federal Government has already brought on the scene of authority several well known members and friends of the Army Ordnance Association whose achievements during the World War and since have ranked them high in national affairs. We refer particularly to Gen. Hugh S. Johnson, administrator of the National Industrial Recovery Administration; Maj. Gen. C. C. Williams, director of our Association and former Chief of Ordnance, now a deputy administrator of the Recovery Administration; and Brig. Gen. William I. Westervelt, formerly of the Ordnance Department of the Army who is Director of Processing and Marketing in the Agricultural Adjustment Administration. Others have been, or are being, "drafted" for service; of these ARMY ORDNANCE will report later. American ordnance and its followers take pride in the elevation of these friends and associates to positions of great responsibility in the new economic order. Judged by their records of the emergency of 1917-18, achievement under their present leadership is assured.

**Brig. Gen. Hugh S. Johnson**

General Johnson, the inventor and motivating power of NIRA, is no stranger to those who engaged in American munitions operations in the World War nor is he less known to all friends of the Army in which he served with distinction for so many years. ARMY ORDNANCE has the privilege of having had him as a contributor to its pages in recent years. The nation was given the benefit of his military and economic prowess as recently as 1931 when he aided so remarkably in the investigations of the War Policies Commission. Soldier, lawyer, manufacturer and economist, General Johnson was born at Fort Scott, Kansas, in 1882. He was graduated from the Oklahoma Northwestern Normal School in 1902 and from the United States Military Academy in 1903. He received his A.B. from the University of California, 1915, J.D. 1916. His active military service began as a second lieutenant of the First Cavalry in June, 1903. He was promoted through grades and became a major in the Judge Advocate General's Department May 15, 1917; Lieut. Col. National Army, August 5, 1917; Colonel, January 8, 1918, and Brigadier General April 15th of the same year. He resigned from the Army February 25, 1919. Since then he has held a brigadier general's commission in the Officers' Reserve Corps.

After his resignation from the Army General Johnson became vice-president, general counsel and assistant general manager of the Moline Plow Company. In 1925 he organized the Moline Implement Company and became chairman of its board. Since 1927 he has been associated with Mr. Bernard M. Baruch, World War chairman of the War Industries Board.

General Johnson's Army service was particularly varied and none the less important. At the time of the San Francisco fire in 1906 he served as quartermaster for refugees. He was with the Army in the Philippines from 1907 to 1909. Two years following he was executive officer of Yosemite National Park and in 1911 became superintendent of Sequoia National Park. He served as Judge Advocate under General Pershing with the Punitive Expedition into Mexico in 1916, following which he became assistant law officer of the Bureau of Insular Affairs of the War Department. In 1917 he became deputy provost marshal general and in March, 1918, as a brigadier general, he organized and directed the purchase and supply bureau of the General Staff. In this connection he served as a member of the War Industries Board and in July of that memorable year was made assistant chief of the Purchase, Storage and Traffic Division. From October 1, 1918, to January 1, 1919, he served first as commander of the 15th Brigade, 8th Division, Camp Fremont, Calif., and commander of that division at Camp Lee, Va.

To General Johnson goes the distinction of originating the rules and policies for the selective draft in 1917 of which he was the executive in charge. To him also was due the organization of the P. S. & T. Division which was in effect from August, 1918, to the close of the war. He holds the Mexican Campaign and World War medals and was awarded the Distinguished Service Medal for his work on the selective draft. He is the author of "Williams of West Point," "Williams on Service," "Selective Service Regulations and Questionaire," "First Report of the Provost Marshal General, 1917," and contributions to the professional and popular journals. As is already known by the country at large, he has, during the short time of his administration of NIRA, given generous evidence of a dynamic personality and learned ability. It is stimulating indeed to observe his translation of the industries board of war time to an industries board of peace. The same method of attack and operation is obvious in both. We have no doubt that the peace effort waged against depression will be as fruitful as was the war effort against a common enemy. Fifteen years ago it was a drive for weapons, today it is a push for wages.

THE unsolicited appointment of General Williams as Deputy Administrator of the Recovery Administration recalls to all friends of American ordnance the man and the munitions policies which are among the brightest pages of our military and industrial history. His career and achievements are an inspiration wherever ordnance is known. His ability and personality have captivated his associates from the lowliest enlisted man to the captains of industry. His vision, fairness and ability to get the right thing done at the right time are without superior in any walk of life. It was only natural that those who were familiar with his successful undertakings in war and in peace should request him to aid in the present emergency.

**Maj. Gen. C. C. Williams**

When General Williams retired from the Army April 1, 1930, General Crowell, president of the Army Ordnance Association, wrote in these pages a personal tribute to General Williams which met with universal acclaim. We can do no better here than republish a portion of that tribute. When it was written it was a factual statement regarding the man and his work. In the light of subsequent developments it is proverbial.

"Smokeless powder and metallurgy were the fields in which General Williams had played conspicuous part as an officer in the lower grades. In 1898 he joined the famous Astor Battery

and saw service as an officer of the Field Artillery with the Army in the Philippines. In 1916 he was Department Ordnance Officer at the time of Pershing's Punitive Expedition into Mexico. He was a member of that first small contingent that sailed with Pershing on the S. S. BALTIC for France, and served as Chief Ordnance Officer of the A. E. F. from June, 1917, to April, 1918. For his World War service he was awarded the Distinguished Service Medal with this citation: 'For exceptionally meritorious and distinguished services. An officer of high professional attainments, who rendered particularly valuable services in the organization of the Ordnance Department of the American Expeditionary Forces and exhibited unusual ability in arranging for the procurement of ordnance material and ammunition for the American Army in Europe.' His service was also recognized by three foreign governments, having been honored with Officer and later Commander of the Legion of Honor (French); Companion of St. Michael and St. George (British); Commander, Order Polonia Restitua (Polish).

"I find every attribute of the real officer, administrator and executive in the career of General Williams. First among these should be placed his broad viewpoint—a characteristic not always present in our best executives of civil and military calling. Definite and clear-cut in his objectives, nevertheless compromise found place in his decisions. Such a makeup has tremendous directive force particularly in the complicated technical and scientific field of ordnance. I should call it General Williams' business outlook. His is not the bureaucratic mind or temperament. Indeed the much discussed slogan 'putting business into Government' has no truer personification than General Williams. Coincident with this viewpoint was his innate ability to select men. I doubt if any branch of our great World War machinery excelled in quality the men selected by General Williams to carry on with him the work of his department. This, coupled with his organizing ability, placed the work of the Department on a plane of such efficient degree that it surmounted insuperable difficulties and established a record for all time in the speed and efficiency with which its problems were met and its programs fulfilled.

"In the sphere of post-war activities General Williams rose to even greater heights. It is one thing to accomplish when the stimulus of actual war is present and quite another when in peace our traditional disinterestedness in weapons is almost universal. Thanks to him, peace brought opportunity for further development which under his leadership was revolutionary. He made his department, I may say without exaggeration, a byword for high morale, efficient operation and splendid performance. The best of his accomplishments in this period, in my judgment, was the zeal with which he nurtured the infant prodigy, Industrial Preparedness. The World War proved modern munitionment to be essentially an industrial problem. No one accepted that conclusion more completely than General Williams and no one endeavored to apply it with more understanding. After 11 years of trial and operation, this new theory is definitely a part of our national defense plans coequal in acknowledged importance with any and all other elements of our system. General Williams with his clear perception of fundamentals gave this newcomer just the proper degree of impetus necessary to assure that it did not falter or go astray.

"There were other matters of vital importance to which his energy was applied with equal vigor. I can refer only to the principal developments of his tenure. Taking the major classifications of ordnance, we find practically every item of the Caliber Board recommendations for rearmament successfully developed. That board, it will be remembered, specified the desired characteristics and the types of our new weapons in the light of World War experience. Our new light and heavy artillery represents exceptional advancement. Our coast defense armament likewise is a great improvement over the old. Our small arms have developed to the point of a new semiautomatic rifle soon to be adopted. Our ammunition of all classes as to powder, fuzes and all other components has progressed in design and serviceability equally with the weapons in which it is used. Our developments of bombs, from practically nothing of World War days to the present, have advanced to the point where for demolition and fragmentation effect they meet the requirements of modern tactics. The airplane in its evolution to present efficiency has had flying in unison with it a bomb program without which the efficiency of our air force would be greatly lessened if not entirely inadequate. Simultaneously we have seen the striking power of the plane curbed by our new antiaircraft guns. Certainly no period in the entire history of the development of weapons has seen the advancement of any instrument of defense comparable to that of antiaircraft during the past twelve years.

"Our tanks meet the exacting demands of tactical use and commercial production. While there has been some difference of opinion on the exact types of tanks, it must always be said that General Williams viewed the problem in a spirit of open-mindedness and coöperation. Our armament has been designed with the one objective: satisfaction to the using services. His attitude always was 'Can their expressed needs be met'—not should they be. This was the Williams' motto, and to it should be laid the cause of the splendid esprit between all services of the Army and the Department. To the man himself, his personality and his ability, we must accredit the unusual morale of his organization."

IF there is one name in American military annals which since the days of the World War has taken on almost biblical significance it is that of Brig. Gen. William I. Westervelt who has been appointed Director of Processing and Marketing in the Agricultural Adjustment Administration. General Westervelt will assist the administrator, Mr. George N. Peek (also a member of the Association) in carrying out the revolutionary undertaking to raise farm commodity prices. Judged by the success which the Westervelt Board program (it has served as the bible of post-war design) achieved for the Army, it is a fair assumption that agricultural adjustment under the Peek-Westervelt combination is in capable, energetic hands.

**Brig. Gen. William I. Westervelt.**

General Westervelt was born in Corpus Christi, Texas, in 1876 and was graduated from the U. S. Military Academy in 1900. He served in various capacities in the Ordnance Department and was appointed Brigadier General, National Army, April, 1918. His Army service took him to the department of Texas and the Philippines, a tour of duty as instructor in the Department of Philosophy at the Military Academy, 1904-6, inspector of ordnance at the Midvale Steel Works, 1906-7, and membership on the Field Artillery Board, 1910-11. General Westervelt arrived in France, July, 1917, and served first as brigade adjutant of the First Artillery and materiel officer for Army artillery of the First Army. Later he became assistant to the Chief of Artillery of the American Expeditionary Forces and returned to the United States in March, 1919. He was commanding officer of the Watervliet Arsenal until September, 1923, when he was appointed Military Attaché for ordnance at the American Embassy in Paris. This important office he held until his retirement from the Army in 1927. Since that time he has served as research director for Sears Roebuck and Company of Chicago.

The investigations and recommendations of the Westervelt

Board which was convened immediately after the World War to study and apply the lessons of that conflict to the needs of American armament is one of the signal contributions to the history of ordnance. Sometimes referred to as the Caliber Board, that body under the chairmanship of General Westervelt laid down the specifications for all classes of matériel which our Army has had as its guide in the intervening years. By a fortunate circumstance the new order thus utilizes the ability of General Westervelt who prescribed what post-war American ordnance should be, and that of General Williams who as Chief of Ordnance saw to it that the recommendations of the Westervelt Board became accomplished facts in nearly all classifications.

ALL members of the Army Ordnance Association will be interested to know that Col. Frederick H. Payne, formerly the Assistant Secretary of War, has returned to the Greenfield Tap and Die Corporation of Greenfield, Mass., having been elected chairman of the board at the meeting of directors on July 10th.

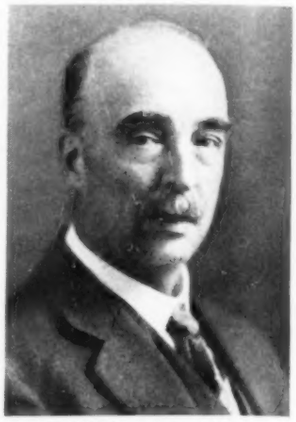
**Col. Frederick H. Payne**

Thus Colonel Payne, whose tour as the Assistant Secretary from May, 1930, to March, 1933, was marked by an unusual degree of progress of our industrial mobilization plans, carries on the affairs of one of our important machine tool organizations which he had left to assume the Assistant Secretaryship. He organized Greenfield Tap and Die in 1912 when he became its first treasurer and later vice-president and general manager. He left the company during the World War to become district procurement officer and assistant district chief of the Bridgeport Ordnance District and after the Armistice was a member of the district claims board. Later he spent five years in New York as a member of the firm of Tucker, Anthony & Company, returning to the Greenfield Tap and Die Corporation as president, which office he resigned to become the Assistant Secretary of War.

Colonel Payne, while deputy head of the War Department, was an untiring exponent of industrial preparedness. We of the Army Ordnance Association are well acquainted with the energy and vision with which he carried out the industrial mobilization provisions of the National Defense Act. He was particularly cognizant of the importance of the ordnance problem and missed no opportunity to hasten its solution. At a time when the very existence of the Army was threatened by a Congress intent upon reduction of officer personnel, his efforts to maintain our small cadre were successful. The entire Army and his own first love—Ordnance—look to him as one who has performed nobly and whose return to private life will not lessen his active concern and help in ordnance affairs.

AMERICAN munitions can ill afford to suffer the loss of Col. Edward F. Miller, head of the Department of Mechanical Engineering at the Massachusetts Institute of Technology, who died at his home in Newton Center, Mass., June 12, 1933. His was an unusually useful life during which he played an important part in the development of Technology and in the advancement of ordnance. He was one of the organizers of the Boston Post of the Army Ordnance Association and a charter member of the national organization.

Upon his graduation from M. I. T. in the class of 1886 Colonel Miller became an assistant in mechanical engineering at the Institute, instructor in 1888, assistant professor of steam engineering in 1892, associate professor in 1899 and professor in 1905. He specialized in boiler design and in the operation and design of steam power plants on which subject he was a recognized authority. In 1911 he was appointed head of the Department of Mechanical Engineering at Technology.



**Col. Edward F. Miller**

In addition to a vigorous and effective discharge of the duties directly pertaining to his official position, Colonel Miller was very active and exercised a wise influence in the general affairs of the Institute. He was sent to Europe in 1904, by President Pritchett, to study the methods of engineering education in foreign technical schools. He visited many institutions in England, France and Germany and upon his return made a report to the Corporation which materially influenced later work at the Institute.

Colonel Miller took an active part in the planning and work incident to the removal of Technology from Boston to its present site in Cambridge. The plans for the laboratories, drawing rooms and lecture rooms for the Mechanical Engineering Department were drawn up under his supervision. The final layout of the mechanical engineering laboratories, machine tool laboratories, foundry, carpenter shop, forge shop and mechanical engineering drawing rooms resulted from two years of intensive study under his direction.

In 1917 Colonel Miller had sole charge of the establishment and control of a number of schools established at various places in the country for the purpose of giving fundamental training to engineer officers to enable them to operate the engine rooms of ships being constructed under the direction of the U. S. Shipping Board. Under his direction 13 of these schools were established. In addition to one at the Institute of Technology others were located in New York, Brooklyn, Jersey City, Hoboken, Chicago, Cleveland, Philadelphia, Seattle, New Orleans, Baltimore and Berkeley, California. About 2,000 men in all received instruction at these schools and a large majority of them were commissioned as engineer officers in the U. S. Merchant Marine.

Always a staunch believer in national defense, during the war he was engaged in confidential work for the Army under the Commanding General of the Northeastern Department. He was an active sponsor and friend of the R. O. T. C. movement and had an important part in the establishment of an R. O. T. C. Unit at Technology. He was commissioned a Colonel in the Ordnance Reserve on January 14, 1922, and continued actively in the work of the R. O. T. C. up to the time of his death. He was Dean of Army Students and took great pride and pleasure in facilitating the work of the numerous members of the military and naval services who were from time to time in attendance at the Institute. He contributed very materially both as an instructor and as an administrator to the highly successful operation of that portion of the work of the Ordnance School which is given at Technology.

His passing leaves vacant in the ranks of the Army Ordnance Association a place which only Colonel Miller could fill.

APPROPRIATELY, although unfortunately, ARMY ORDNANCE records the death of a civilian ordnance engineer who typified in his life and work those essential qualities to which we have called attention in the editorial in this issue on page 44. No finer example of what the ordnance civilian engineer means to the service can be found than in the life work of Harry C. Zimmerman, late of the Artillery Division, Office of the Chief

of Ordnance, who died in Washington, D. C., June 19, 1933, after a lingering illness.

A native of Baltimore, Md., where he received his early education, Mr. Zimmerman began his long service at the Watervliet Arsenal as a draftsman in 1905. In that year he was transferred to the Ordnance Office where he served practically continuously until his death.

While he was familiar with and assisted in the design of various types of mobile and harbor defense artillery his principal work was in the design of division artillery. In 1912 he designed the first split trail carriage made by the Ordnance Department, the 3-inch gun carriage, Model 1913. This carriage with slight modifications became the 75-mm. gun carriage, Model 1916, several hundred of which were manufactured during the World War. In the World War period he was responsible for converting the French drawings of the 75-mm. gun carriage, Model 1897 and the 155-mm. gun carriage, Model 1918, to American practice, and in this connection had charge of the secret drawings of the recoil mechanisms pertaining to those carriages.

In the post-war period he designed the several 75-mm. gun carriages and 105-mm. howitzer carriages leading up to the 75-mm. gun carriage, M1 and 105-mm. howitzer carriage, M1, now the adopted types for emergency procurement.

During his long service in the Ordnance Department Mr. Zimmerman came in touch with many officers and civilians of the department and by his quiet deportment and courteous demeanor endeared himself to all. His cheerful disposition was especially noteworthy during the last two years of his life when he carried on despite illness and suffering.

He was a worthy representative of that small civilian group of ordnance artisans and engineers who are the mainstay of ordnance progress in our service and whose unsung achievements leave a marked effect on the progress of ordnance design. That group comprises specialists in an art which demands self-sacrifice, application and constant research. Members of it are worthy successors of the guildsmen of old who, as the company of arms artificers kept alive the honorable traditions of weapon design. Mr. Zimmerman was a worthy member of that select group and has left a praiseworthy record in the annals of American munitions.

### NEW MEMBERS

THE following have been admitted to membership in the Army Ordnance Association since the last issue of ARMY ORDNANCE: Andrew Anderson, Jr., Orange, N. J.; Joseph M. Colby, Aberdeen Proving Ground, Md.; G. C. Davison, Lyme, Conn.; Harris A. Dunn, New York, N. Y.; Clayton Farris, Newark, N. J.; John J. Flynn, Somerville, Mass.; John H. McElhinney, Coatesville, Pa.; Theodore J. Miller, Olean, N. Y.; Sterling Murdock, Berkeley, Calif.; Robert P. Parrott, Washington, D. C.; M. Vincent Pesce, Seattle, Wash.; Calvin H. Rhodebeck, Queens Village, L. I., N. Y.; Lewis M. Rumsey, Jr., St. Louis, Mo.; William F. Russell, Jr., New York, N. Y.; Clinton Shafer, Jr., New York, N. Y.; R. N. Stubbs, Jr., Lynchburg, Va.; Robert K. Sturgess, Glendale, Calif.; C. Weldon Thomas, Rodeo, Calif.; Edmund Tweedy, Easton, Md.; Wm. Lester Walls, Stanford University, Calif.; Roswell H. Ward, Newark, N. J.; Charles J. Westin, Philadelphia, Pa.; Paul F. Wimberly, McCormack, S. C.; Samuel H. Woods, Aberdeen Proving Ground, Md.

### NECROLOGY

SINCE publication of the last issue of ARMY ORDNANCE notice has been received of the death of the following members of the Association: W. P. Dallett, Philadelphia, Pa.; A. R. Erskine, South Bend, Ind.; A. S. Losey, Middletown, Conn.; E. P. Lynch, St. Louis, Mo.; G. F. Meehan, Chattanooga, Tenn.; William F. Russell, New York, N. Y.; and John H. Tweedy, Jr., Easton, Md. To relatives and friends of these deceased members of the Association ARMY ORDNANCE extends condolences.

## AOA

## *Professional Notes*

### A CHANGE IN STANDARDS DEVELOPMENT

THE following activities of the National Bureau of Standards, are to be transferred to the American Standards Association, a federation of 37 national technical societies, trade associations, and governmental bodies, with headquarters in the Engineering Societies Building, 29 West 39th St., New York, as the result of an arrangement worked out between Secretary of Commerce Daniel C. Roper and President Howard Coonley of the American Standards Association: Division of Trade Standards, Division of Specifications, Division of Simplified Practice, Building Code and Plumbing Code Sections of the Building and Housing Division, and the Safety Code Section.

In authorizing the transfer of these groups from the Bureau Mr. Roper wrote as follows to the President of the American Standards Association:

"The Bureau of Standards is discontinuing most of the work which it has been carrying on in the field of simplification, commercial standards, safety codes, and building codes. This step, undertaken in the belief that these functions should be in the hands of industry and consumer groups, is being carried out as a part of the government economy program.

"I am pleased that we shall be able to count on the American Standards Association to carry on the essentials of this work, which, as a result of our discussions I now understand the Association will be prepared to do. Its experience and standing as the national clearing house for industrial standardization, and the cooperative methods which it has developed during the past 15 years fit it for the increased responsibilities and the enlarged program entailed. It is thus possible to conserve the results of these pioneering services to industry which the Bureau of Standards has developed during the last 12 years, and to further the national economy by carrying these services forward.

"I can assure you that the full cooperation of the Bureau of Standards will at all times be available both in carrying through the transfer with a minimum of disruption of the work, and also in providing through the Bureau's facilities at least a part of the research work necessary in connection with standardization projects."

Savings amounting to hundreds of millions of dollars, ranging from $1,000,000 for the paving brick industry to $200,000,000 for the lumber industry, have resulted from the work which the Bureau of Standards is discontinuing and which the American Standards Association hopes to carry on in behalf of industry, according to estimates made by the industries. In addition to actual money savings, the public is benefitting by getting better values, prompt deliveries, quick replacement service, and lower maintenance cost on many of the industrial products which it purchases.

The Bureau states that for the manufacturer the standardization program permits more comprehensive planning, more prudent investments in raw materials for longer runs, and easier financing through the reduction of inventories and stocks. It is also possible for manufacturers and distributors to carry more complete lines of simplified goods with lower warehousing and storage space requirements, less expense for sales, handling, and clerical cost. More expeditious service from the manufacturer enables the distributor to pass on to the consumer benefits in quicker deliveries and prompt servicing, when interchangeable parts are involved.

The American Standards Association was organized in 1918 by five major engineering societies to serve as a clearing house through which the standardization work of technical and industrial bodies would be correlated and to prevent the duplication of work and the promulgation of conflicting standards.

Any responsible trade, technical, social, or governmental organization can request the initiation of a standardization project under the procedure of the Association.

The American Standards Association is a member of the International Standards Association and acts as the official channel for international coöperation in standardization work with the similar national standardizing bodies in each of twenty foreign countries.

Up to the present time, the Association has approved 237 national industrial standards, and projects for 135 other standards are under way. Nearly 3000 technical experts representing more than 500 trade associations, engineering and scientific societies, government agencies, and other bodies are included in more than 400 standardization committees operating under American Standards Association auspices.

### Current Ordnance Progress

A SEMIAUTOMATIC link loading machine for caliber .30 ammunition recently developed by Springfield Armory has been in constant use by the Armory for more than a month and no difficulties whatsoever have been encountered. Rate of loading per man per hour is slightly better than twice as great when using this machine as compared with the lever-operated standard type.

The caliber .50 semiautomatic link loading machine is now undergoing Ordnance test and it is expected that both the caliber .50 and the caliber .30 machines will be supplied shortly to the using service for extended use to thoroughly test these machines.

Seventy-two modern tractors have been obtained through the exchange of 5-ton and 10-ton artillery tractors, M1917, which were beyond the cost of economical repair. These 72 medium tractors have been issued to artillery organizations equipped with 155-mm. howitzers. All Regular Army 155-mm. howitzer organizations within the continental limits of the United States are now equipped with modern tractors.

An improved drill cartridge is under manufacture for test in 3-inch antiaircraft guns. This design follows that of the 75-mm. M7 drill cartridge, which was recently standardized. The new type is a modification of the service drill cartridge, whereby the base is attached to the cartridge by a spring. This relieves the stresses set up upon insertion and extraction in the gun, thereby retarding wear on the base.

Further progress has been made on the problem of the elimination of shellac, a strategic material, in varnishes to be used in connection with the manufacture of ammunition. A major demand for this material in ammunition operations has been eliminated by the adoption, some time ago, of acid-proof black paint as the inside coating of shell and bombs, and the outside coating of booster casings, etc. An attempt has recently been made to obtain a substitute for shellac varnish for use in the attachment of labels to containers, and as a protective coating of labels and stenciling. Outstanding among the various commercial products tested was air-drying Bakelite varnish, which gave protection superior even to that given by shellac. Here again, as in the case of newly developed paints, the difficulty will be to prepare adequate specifications. Work on this problem is being continued.

Report has been received from Picatinny Arsenal on an investigation of "Alumaweld" solder, under the project to obtain substitutes for tin. It appears that the use of this solder will not offer any considerable saving in tin.

A breech bore gage for the caliber .50 machine gun barrel has been developed for the purpose of predetermining the accuracy of machine gun barrels. This gage is practically completed and will be calibrated and given Ordnance test during the next month.

One 3-inch antiaircraft gun mount, M2A1 equipped with an air brake system was tested at Aberdeen Proving Ground with satisfactory results. This system provides synchronized braking of the prime mover and the mount and eliminates the necessity of an operator in the brakeman's seat of the mount.

Instrument Trailer, T7, for use with 75-mm. (all-purpose) battery is nearing completion at Watertown Arsenal. Installation of the equipment constituting the load will be made at Frankford Arsenal. Four 75-mm. gun carriages T2E1 have been completed at Rock Island Arsenal and are now undergoing proof test at the arsenal. Two of the carriages have proof-fired satisfactorily and when the tests of the four carriages are completed the battery will be drawn over the road, by light prime movers, T9, to Frankford Arsenal, where the sighting equipment will be installed. The carriage is designed for use against ground and aërial targets and has pneumatic tires and spring suspension. It may be fired from the wheels or lowered to the ground.

Five 75-mm. gun carriages M1917E2 (British) having pneumatic tired wheels were completed at Rock Island Arsenal and hauled overland to the Aberdeen Proving Ground with a convoy of prime movers, T8. The tests at the proving ground are now completed. Field tests will be continued at Fort Bragg on four of them.

### Beryllium-Copper

BERYLLIUM-COPPER is the designation that has been given by the American Brass Company to a heat treatable alloy of beryllium and copper in which beryllium is present up to about 2¼ per cent. Until recently the amount of beryllium produced has been quite small, but the development of a process of producing a master alloy of copper containing about 12 per cent beryllium has made it possible to produce beryllium-copper on a commercial scale. Fortunately the more valuable alloys contain only from 1½ to 2½ per cent beryllium. Such alloys are ductile when properly annealed, therefore may be cold-worked quite severely. Above the 2½ per cent beryllium range the amount of the beta phase is so great that the alloys cannot be readily cold worked, though they can be easily hot rolled or hot forged up to possibly 4 per cent or more beryllium. However, the alloys having the greatest number of desirable characteristics are those containing from about 2 to 2¼ per cent beryllium.

In color beryllium-copper, when the percentage of beryllium is low, resembles pure copper. If the percentage of beryllium is increased to 2¼ per cent, the alloy has more the appearance of a bronze. Because beryllium is so light the density of the 2 per cent alloy is about 8.25, and of the 2¼ per cent alloy, about 8.20. Heat treatment appears to increase the density very slightly. The alloys above 1½ per cent beryllium are characterized by great hardness after heat treatment, though before the heat treatment their hardness is more comparable to that of a 90 per cent copper, 10 per cent tin-bronze. This hardening due to heat treatment will subsequently be explained at greater length. The tensile strength and allied properties of beryllium-copper after heat treatment are said to be greater than those of any other commercial non-ferrous alloy. For instance, the tensile strength of hard drawn, heat-treated wire will run well over 200,000 pounds to the square inch. Other results of tests have shown the valuable physical qualities of beryllium-copper.

The electrical conductivity may be given as 16 to 18 per cent I. A. C. S. for hard drawn wire, and from 18 to 32 per cent I. A. C. S. for heat-treated wire. The corresponding resistivity would be 60 to 65 ohms per mil foot for hard drawn, and 30 to 45 ohms per mil foot for the heat-treated wire. Preliminary laboratory measurements indicate that the current-carrying capacity is about 36 per cent that of pure copper.

The alloys containing approximately 2¼ per cent beryllium may be readily hot worked or forged. Following the forging

operation, if great hardness and strength are desired, the article should be thoroughly annealed at 800°C, immediately quenched in water, then should be heat treated at a temperature of about 275°C. For cold working, the beryllium-copper must be in a ductile state, that is, it must be well annealed at 800°C and quenched. When so treated, the alloy may be blanked, rolled, drawn, stamped or formed quite severely. Anneals between operations may be required as in the case of ordinary brass or bronze.

The improvement of the beryllium-copper alloys by means of heat treatment is the outstanding characteristic of the material. If annealed beryllium-copper is to be hardened by heat treatment, the temperature required would be about 300°C for a certain length of time, generally about two hours. If, however, the beryllium-copper is cold-worked the effect of heat treatment is much more pronounced and is secured in a shorter time and at a lower temperature, for instance, one to two hours at 275°C. If the heat treatment is done in a molten salt bath, the time required is reduced by one-third or one-half. The reason for this is the more rapid conduction of the heat to the specimen when it is plunged into the molten salt bath.

Many of the properties of beryllium-copper are being studied. The material can be readily brazed, silver soldered, or soft soldered. In order to weld the carbon arc or metallic arc may be employed. Electric spot welding has been successfully done. The alloy does not flow freely under the usual gas welding methods, so these cannot as yet be recommended. Beryllium-copper is not free cutting, but machines about as readily as the harder bronzes. The machining would usually be done before the heat treatment. It is readily plated with nickel, silver, gold, chromium, etc., in the baths commonly employed for such plating. The color of the alloy makes it particularly favorable for gold plated ware.

Beryllium-copper may be used advantageously where good electrical conductivity is desired, together with high strength and high fatigue resistance. The alloy is non-magnetic and non-sparking. Its qualities make it suitable for high strength wire, aerial wire, metal parts near compasses, for contact fingers, fuse clips, timer parts and all sorts of electrical switch parts. Around powder plants, lacquer plants, oil refineries, for storage tanks and gas works beryllium-copper has been found useful for tools because of its non-sparking quality and great hardness. For instance, the Brinell hardness of a heat treated chisel is about 380. Firing pins have given exceptional service under firing tests with no shell in the pistol chamber. One pin tested failed after about 25,000 impacts of the hammer. Various other applications are being considered and parts are under test. It is to be expected that in many cases beryllium-copper will be found suitable and economical, considering the extra strength and service to be secured from its use.

### INDUSTRIAL PREPAREDNESS IN FRANCE

REVIVAL of an organization in France to perform on a less extensive scale the functions of the Ministry of Armament in the World War was announced recently. The new directorate, according to a governmental decree dated April 29, 1933, will be responsible for the manufacture of all armament, munitions and war material both in peace and war and for the preparation and administration of industrial mobilization plans. The new organization will include several technical organizations formerly under the artillery and other directorates. Gen. H. A. M. Saltet de Sablet d'Estières, Inspecteur Permanent des Fabrications de l'Artillerie, has been appointed Directeur des Fabrications d'Armament. Since the new organization is merely one of planning and administration it is said that no increase in expenditure will be involved. Personnel will be drawn from the officers of the artillery and other arms. This modification appears to parallel the system adopted in the United States under the National Defense Act, the Directeur and his organization being responsible as is our Assistant Secretary of War for procurement planning.

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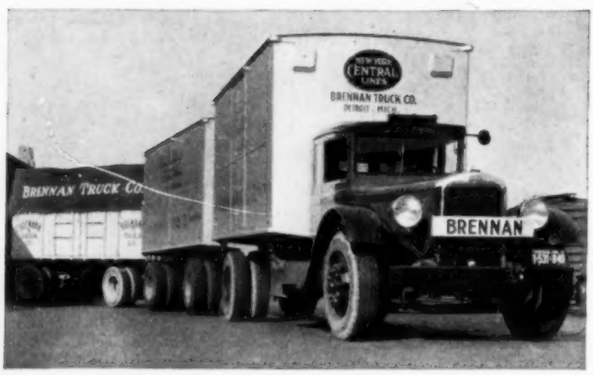


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## *Book Reviews*

THE FIGHTING TANKS SINCE 1916. By Maj. Ralph E. Jones, Inf., U. S. Army; Capt. George H. Rarey, Inf., U. S. Army; First Lieut. Robert J. Icks, Inf. Res., U. S. Army. Washington, D. C.: The National Service Publishing Co. 1933. $3.75.

ANY military book bearing, as this volume does, the enthusiastic endorsement of the reigning potentates of the General Staff, Ordnance and Infantry, gets off to a flying start. Of "The Fighting Tanks" General MacArthur writes, "The reader will possess a full and accurate knowledge of the facts as they exist today;" General Hof calls it "A most complete and comprehensive collection of historical and statistical data;" General Fuqua says it supplies "tank data in quick and handy reference form." Under such auspices a reviewer's task is cut out for him and it is a pleasant task indeed.

The Jones-Rarey-Icks triumvirate has gone further than its sponsors have been able to indicate in their brief eulogies. The authors have compiled a factual record up to now on the most talked of new element of the battlefield. Since that misty morning in 1916 when the tank first made its bow to an unappreciative audience much fur has flown about its past, its present and its future. Debate at times has become so involved that first principles have suffered. Any contribution to the literature which aims to state the case in terms of fundamental facts serves the purpose of clearing perspective. Not since untimely death stilled the hand of Fritz Heigl have encyclopedists of the tank nominated a worthy successor to *Taschenbuch der Tanks*. We bestow upon the authors of "The Fighting Tanks" the deserved title of the mechanized musketeers for Athos, Porthos and Aramis did no finer work in their profession than have these codifiers of the first humanized American tank text. They have qualifications aplenty. Major Jones is a past instructor in the Tank School, past member of the Tank Board and past Battalion Commander of the First Tank Regiment. Captain Rarey used to be an instructor in mechanical subjects at the Tank School; he is now in the Department of Experiment at the Infantry School. Lieutenant Icks needs no introduction to readers of this JOURNAL. Not because he is the lay member of the trio but because he is an especially versed student of a subject to which he is "guide, philosopher and friend," Lieutenant Icks rounds out the panorama. These three "tanketeers" have divested their text of dogmatic highlights and added the tones and shadows which the tank picture does not usually have.

There are in effect three grand fronts on which this attack on the history of tanks past and present is waged. The first phase which opens up after such preliminary obstacles as definitions, etc., are cleared, is a complete reconnaissance of tank combat history of the British, French, German and American armies. Each major engagement in which tanks of various models in the respective armies made their first appearance and the later engagements in which they took part are described faithfully. This part of the volume is easily the best topical analysis of World War and post-war military operations in which tanks have played a part.

The other theaters of operations are equally important. Five chapters are given over to detailed descriptions of the tanks of all countries. In the case of the United States this chronology begins with the gas-operated, electric and steam track-laying tanks and is sufficiently current to include the Christie light tank,

model 1932. The illustrations, of which there are in all some 250, are an inestimable aid to the student as well as to the casual reader.

It is only where the authors branch off into several chapters devoted to tank organization and tactics that this reviewer gets beyond his depth. That depth unconsciously is measured in terms of a yet-to-be-given definition of the ultimate place of the tank in battle. He hesitates to say that he is convinced of the correctness of the future of antitank defense or the offense of the tank itself. Based on post-war experience, we have not much more than the beginnings of evidence on which to proceed. Nevertheless these intrepid authors are specialists in their subjects and their opinions are to be given first rank. They have quite properly put down the present tank defense doctrines of the German, British, French and Japanese authorities.

This long awaited volume should have a tremendous influence on the future of the tank so far as our own Army is concerned. It would have such influence if it did nothing more than present tank data in one place, that vast accumulation of information which heretofore has been scattered throughout the literature. Considering that "The Fighting Tanks" does this and much more besides, we undertake to express to the authors and publisher the appreciation of every student of tanks for their splendid work. At the same time we recommend the text to every tank student and to the plain enthusiast for its sheer merit.

ANDREW JACKSON, THE BORDER CAPTAIN. By Marquis James. Indianapolis: The Bobbs-Merrill Co. $3.75.

BORN on the frontier, in 1767, eye-witness of the revolutionary skirmishes in the Carolinas, law student, senator, judge, major general and victor at New Orleans, are the successive steps in Andrew Jackson's career that Marquis James depicts in this brilliant biography that concludes with the year 1821. A veritable product of the frontier, Jackson combined unlimited energy with an indomitable will. He early decided that the American boundaries should be extended. Hence his intense interest in his military avocation that eventually became his vocation for some years. We seek in vain for any evidence of intellectual preparation for the rank of major general. Indian warfare was his only school of strategy and tactics, and there he learned the practical conduct of war. He was a born leader, and nothing daunted him when his mind was made up, neither terrific odds nor an unexpected turn of events. His extraordinary invasion of Florida, then Spanish territory, without specific orders, and in fact, all his career described by Mr. James, reveals a ruthless disregard of anything that obstructed his individual or national ambition. Nevertheless, his personal and family relationships showed a deeply affectionate nature.

Mr. James' book is one of the notable contributions to biography in recent years. He has penetrated below the surface of facts to find the soul of the man. He has analyzed the significance of the frontier in Jackson's personal development. The book is as exciting as Jackson's career, and it vivifies the period of American history from the Revolution to the end of the War of 1812. The well-drawn maps and excellent illustrations are not surprising in a work whose making has obviously been the result of much painstaking research and careful investigation.

THE MARCH OF DEMOCRACY. VOL. II: FROM CIVIL WAR TO WORLD POWER. By James Truslow Adams. New York: Charles Scribner's Sons. 1933. $3.50.

THE second volume of this new history of the United States covers the years from 1860 to 1933. Mr. Adams continues the policy of presenting the facts of our development and expansion rather than attempting an interpretation of these facts. This volume provides, even better than the first, a reasonable and satisfying balance between the various phases of the nation's life. Few major sins of omission or errors can be detected.

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**"THE FIGHTING TANKS SINCE 1916"**

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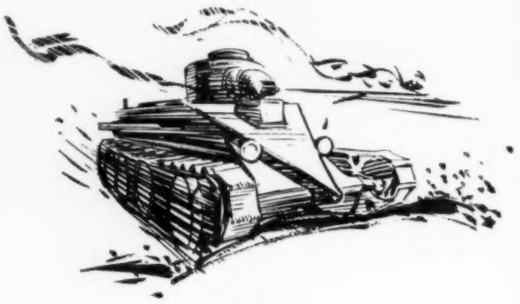

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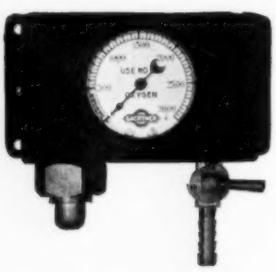

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The Army officer will, however, scarcely relish the paragraph discussing the Army and Navy in the World War. The author might well have added after writing: "The routine of an American Army officer's life is conducive neither to ambition nor energetic work," that in spite of such conditions, American Army officers are frequently ambitious and are hard workers. Of greater moment is his preposterous contrast of the Army and Navy officer in the same paragraph. An author of Mr. Adams's broad knowledge should be aware that Congress maintains the Navy as the first line of defense, necessarily ready to fight at a moment's notice. The Army is skeletonized and requires expansion in the event of war. Ascribing the Navy's instant readiness to the "higher professional morale" of the naval officer, with all due respect to the excellent officers of our sister service, is an amazing instance of failure to grasp a fundamental distinction between our land and sea forces. An author of Mr. Adams's ability detracts from his own standing in thus understating a condition.

The "March of Democracy" is readable, and is, in the main, a scholarly and valuable contribution to the field of American history.

LORD JEFFERY AMHERST, A SOLDIER OF THE KING. By J. C. Long. New York: The Macmillan Company. 1933. $4.00.

AS A loyal son of Amherst College, Mr. Long has written a biography of Lord Jeffery Amherst that is obviously a labor of love. It is a well documented portrayal of a worthy British soldier who was commander-in-chief of the King's forces in America from 1758 to 1763. Moreover in its incidental illumination of the pre-revolutionary American scene and of England during the revolution the book performs a valuable service.

Amherst was undoubtedly the outstanding soldier of the British army at the particular moment. In spite of the author's strong case for Amherst's ability as a leader, the military student cannot quite forget Amherst's excessive caution at Ticonderoga, nor his hazardous strategy later in dividing his forces into three widely separated armies converging on Montreal. Since the Montreal campaign was eminently successful and made Canada a British colony, Mr. Long's enthusiastic praise, however, is certainly not without considerable justification.

Mr. Long's biography is based on sound documentary evidence, most of it recently discovered. It is a refreshing variant from the romanticized biographies founded largely on imagination that flourish at this time.

The Index to ARMY ORDNANCE, Volume XIII, which concluded with the last number, is now available. It is arranged by subject and author alphabetically and includes title page for binding. Copies of the Index will be furnished without cost upon application to the Editorial Office.

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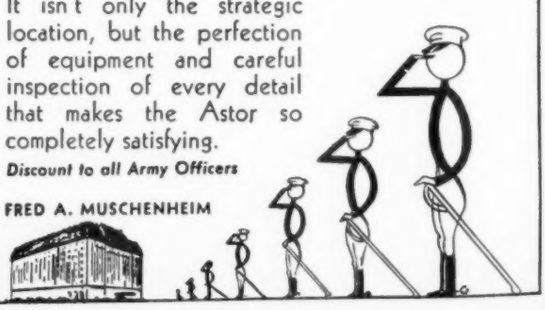
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